US009246286B2

(12) **United States Patent**
Stowers et al.

(10) **Patent No.: US 9,246,286 B2**
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(54) **HIGH SPEED DATA MODULE FOR HIGH LIFE CYCLE INTERCONNECT DEVICE**

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(73) Assignee: **Virginia Panel Corporation**, Waynesboro, VA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/496,178**

(22) Filed: **Sep. 25, 2014**

(65) **Prior Publication Data**

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Related U.S. Application Data

(60) Provisional application No. 61/882,091, filed on Sep. 25, 2013, provisional application No. 61/901,723, filed on Nov. 8, 2013.

(51) **Int. Cl.**

H01R 24/84	(2011.01)
H01R 13/502	(2006.01)
H01R 13/514	(2006.01)
H01R 13/504	(2006.01)
H01R 13/627	(2006.01)

(52) **U.S. Cl.**

CPC ***H01R 24/84*** (2013.01); ***H01R 13/502*** (2013.01); ***H01R 13/514*** (2013.01); *H01R 13/504* (2013.01); *H01R 13/6273* (2013.01)

(58) **Field of Classification Search**

CPC H01R 13/514; H01R 24/84
USPC 439/712, 713, 717, 715, 716
See application file for complete search history.

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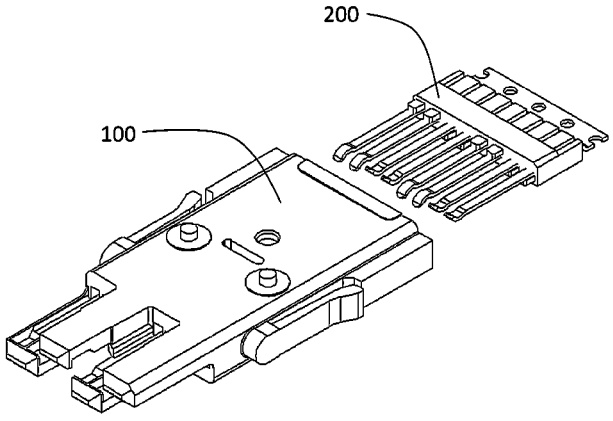
Primary Examiner — Ross Gushi

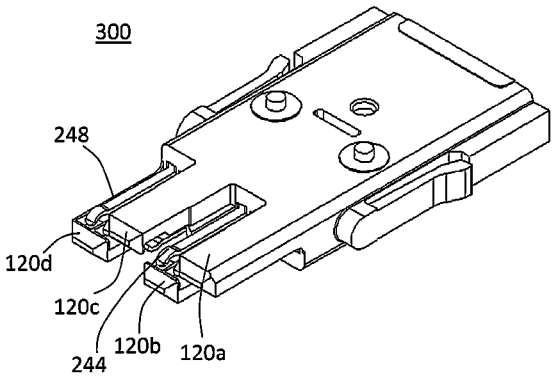
(74) *Attorney, Agent, or Firm* — 24IP Law Group; Timothy R DeWitt

(57) **ABSTRACT**

A hermaphroditic high speed data contact set having an insert shroud and a termination subassembly. A plurality of protective arms extend from its front to protect contact beams of the termination subassembly and provide multi-stage pre-alignment of contacts during engagement. A plurality of raised bosses engaged with a plurality of hollows in the bottom of an adjacent insert shroud to allow stacking of contact sets. A pair of latches lock the insert shroud into a module after insertion. A pair of keying members on the sides of contact set prevent incorrect insertion of a contact set into a module.

15 Claims, 27 Drawing Sheets





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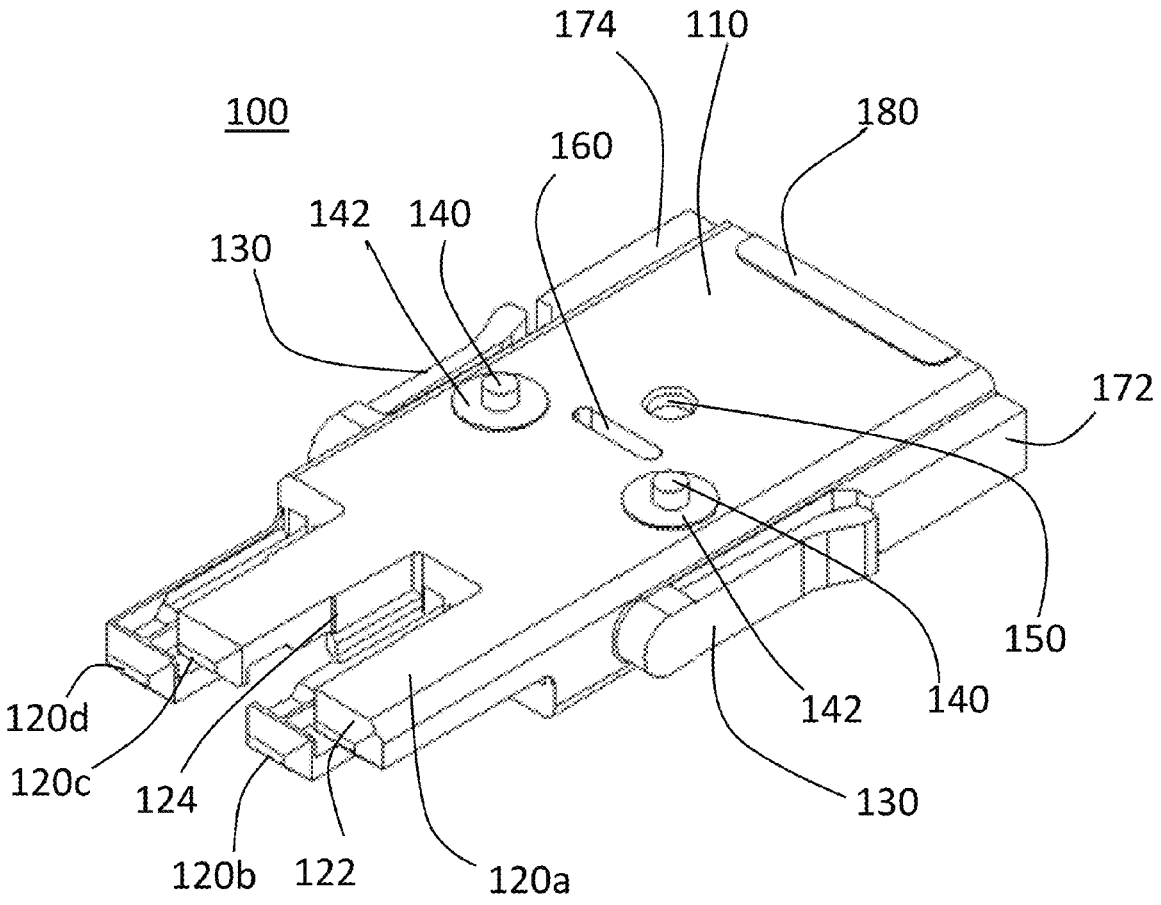
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FIG. 1

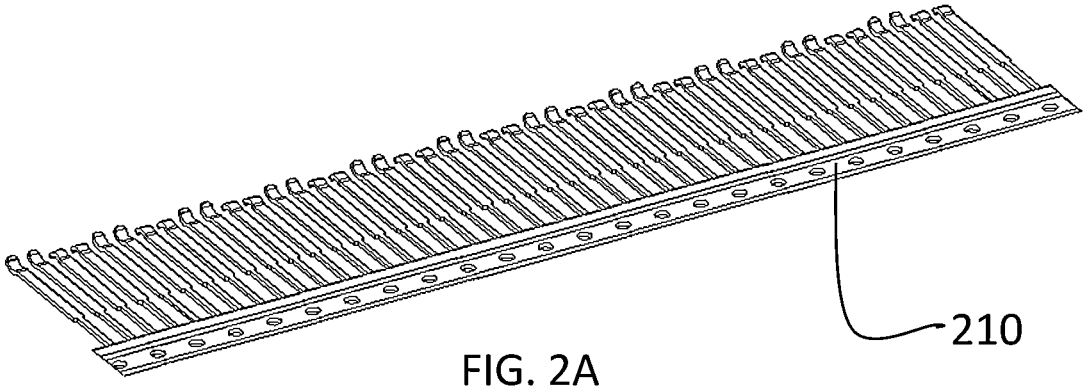

FIG. 2A

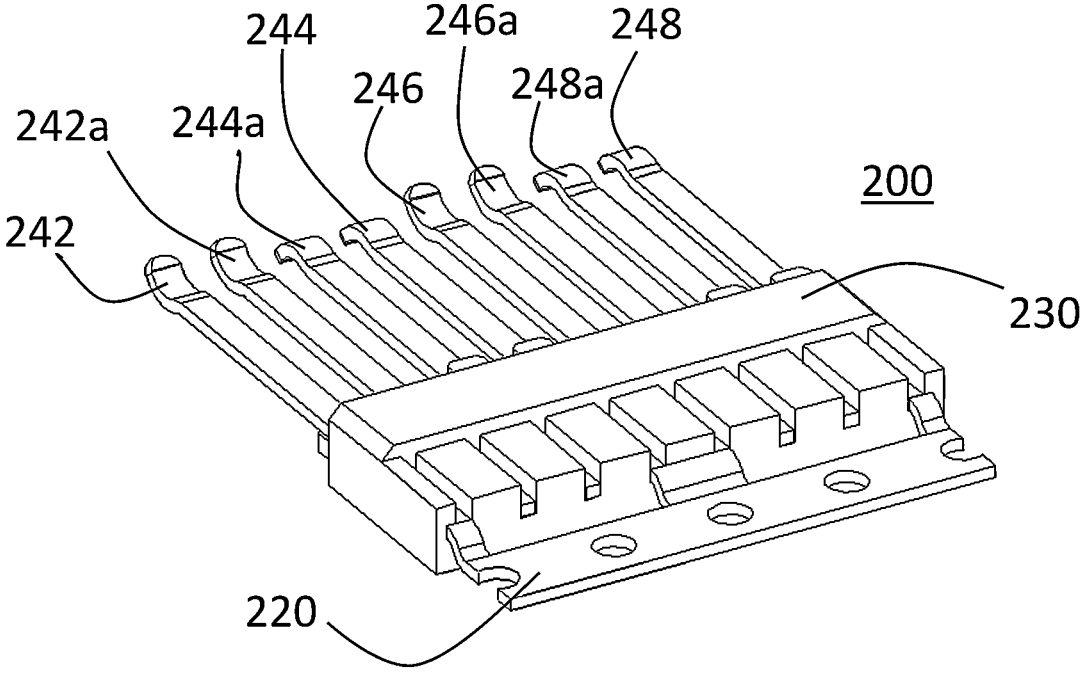

FIG. 2B

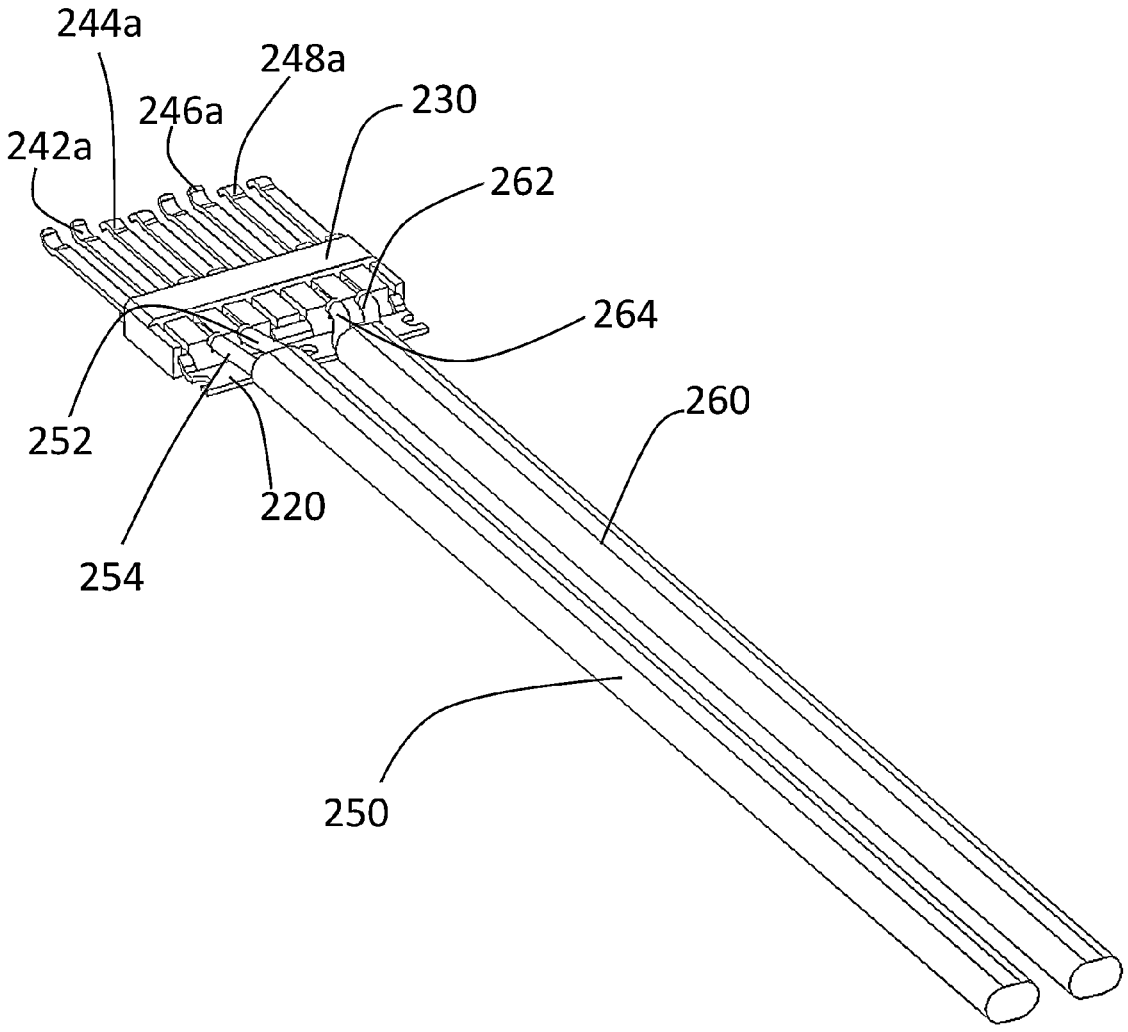

FIG. 2C

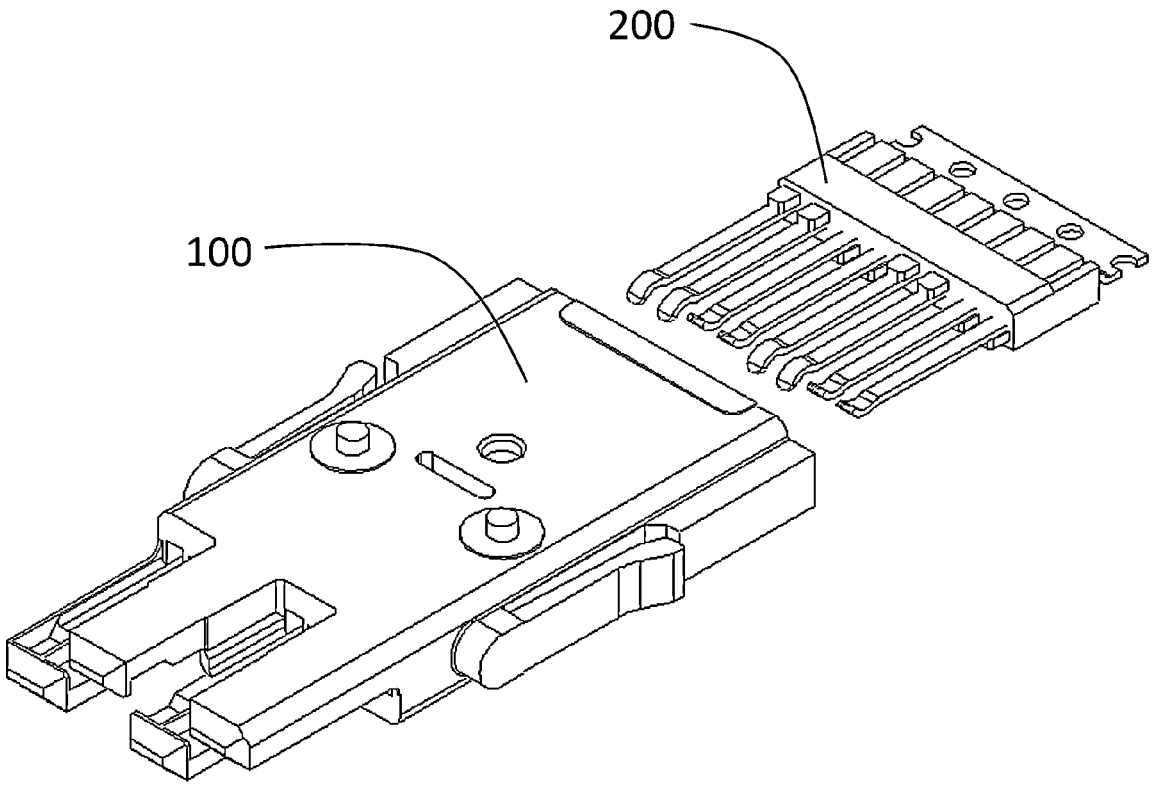

FIG. 3A

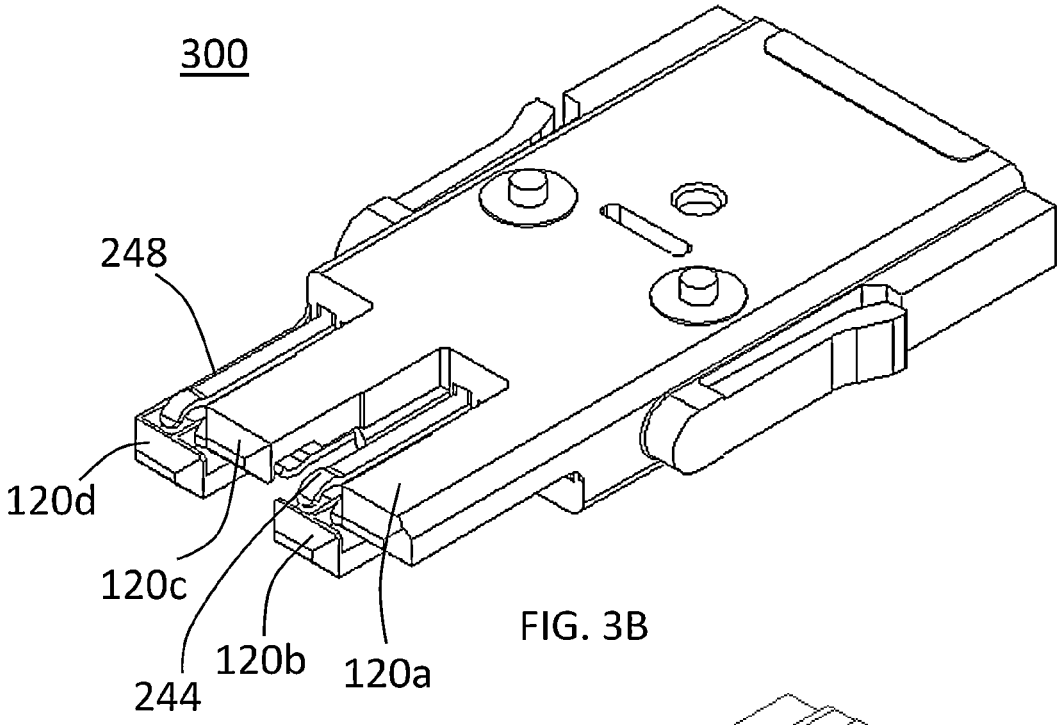

FIG. 3B

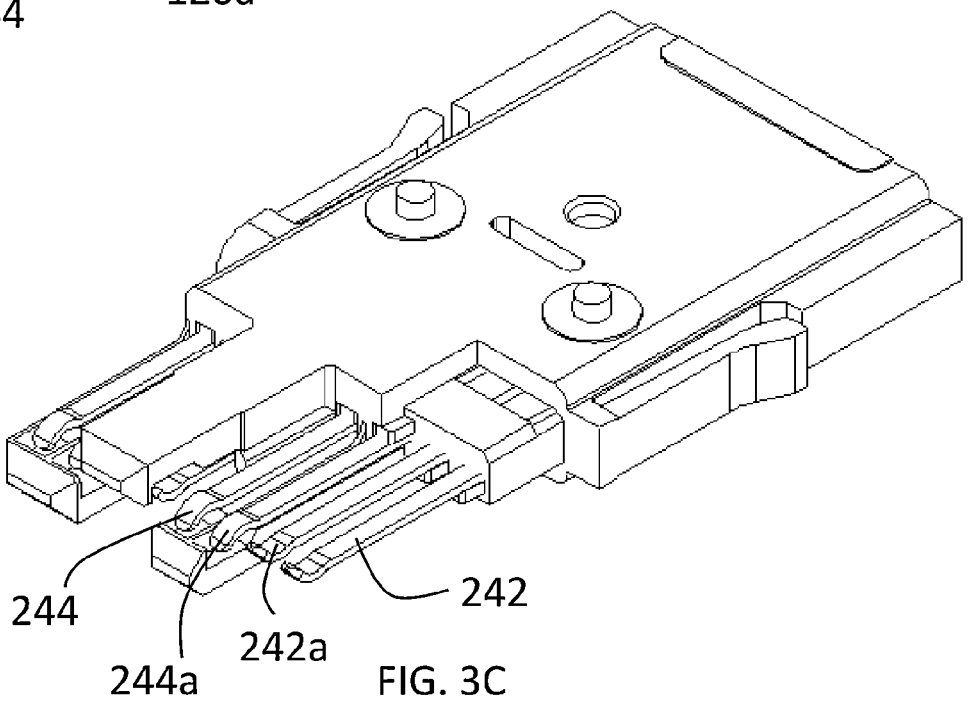

FIG. 3C

FIG. 3F

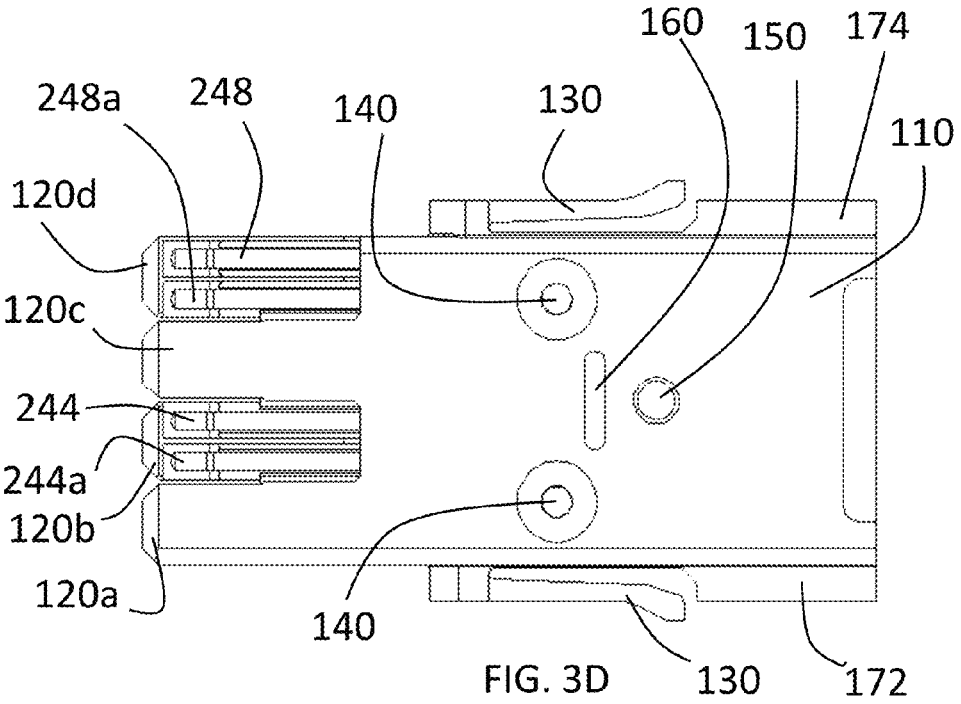

FIG. 3D

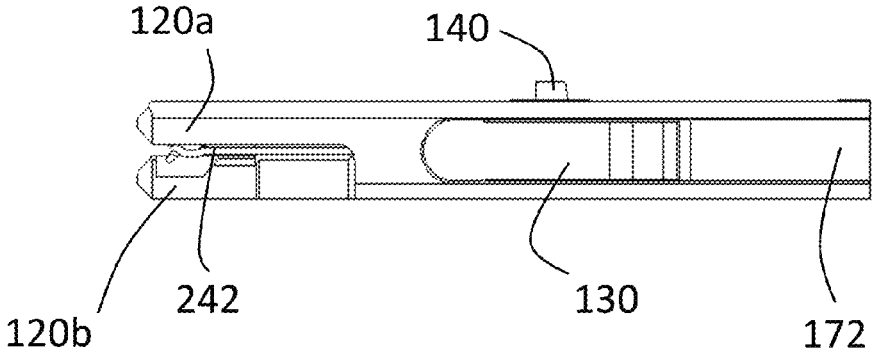

FIG. 3E

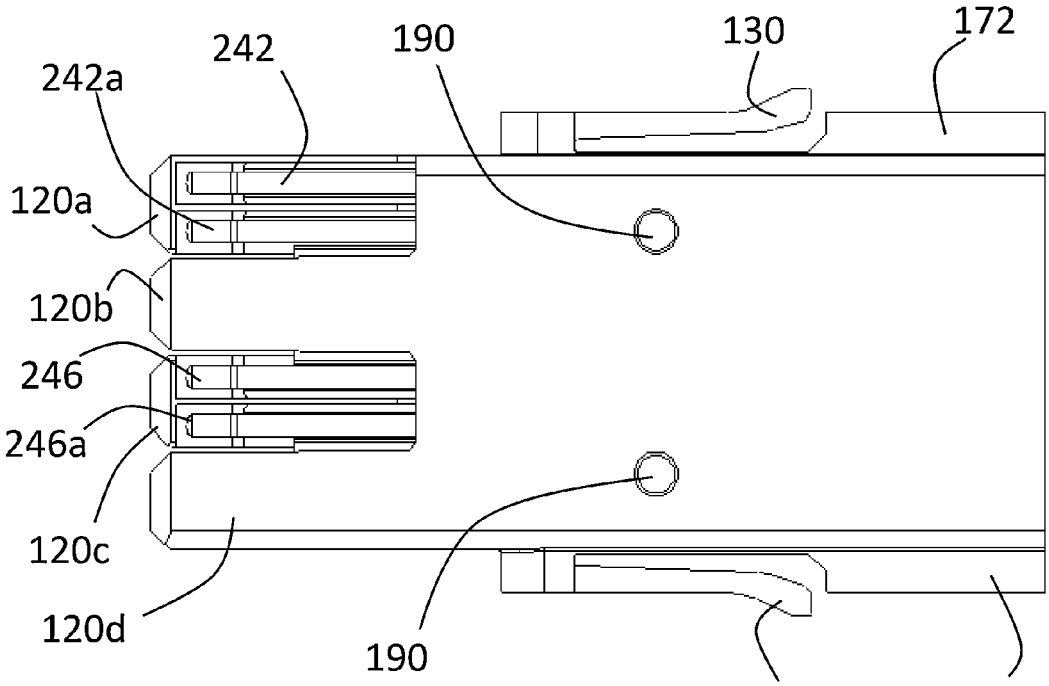
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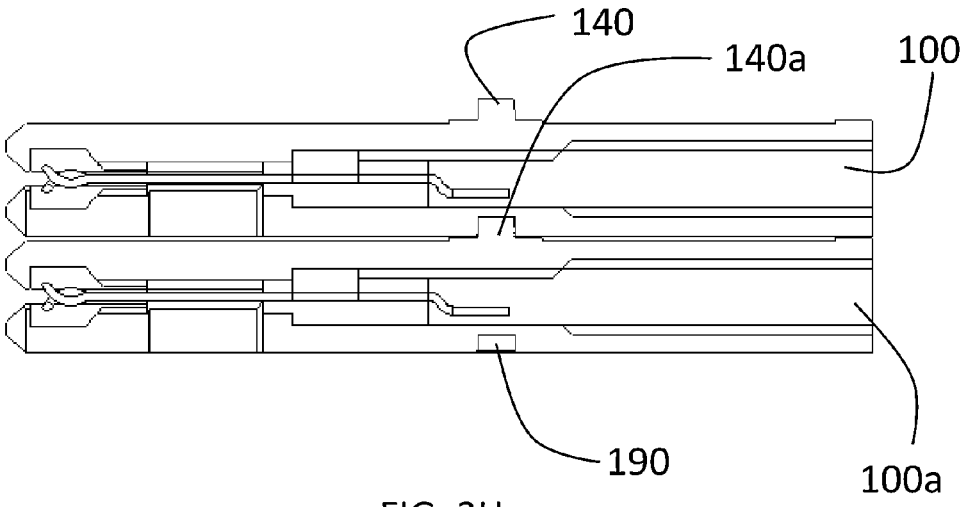
FIG. 3G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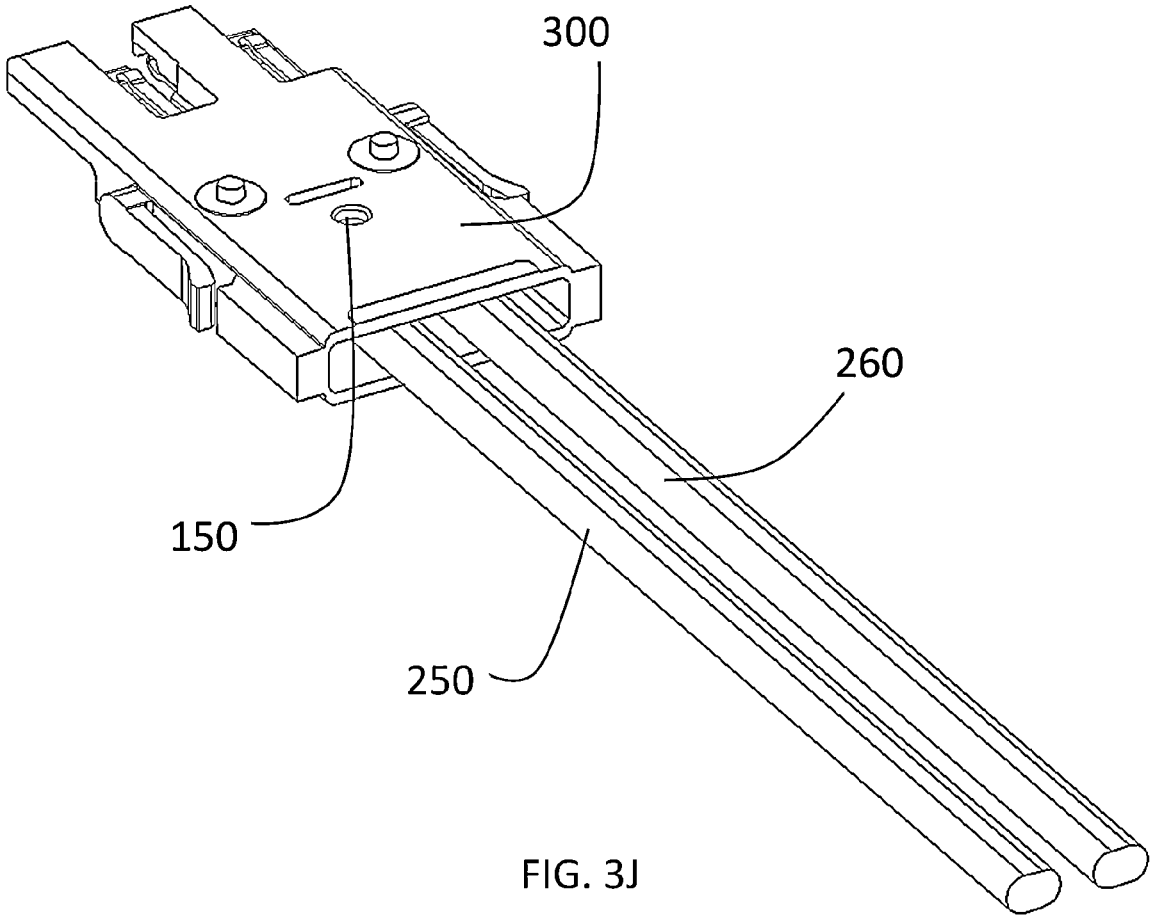

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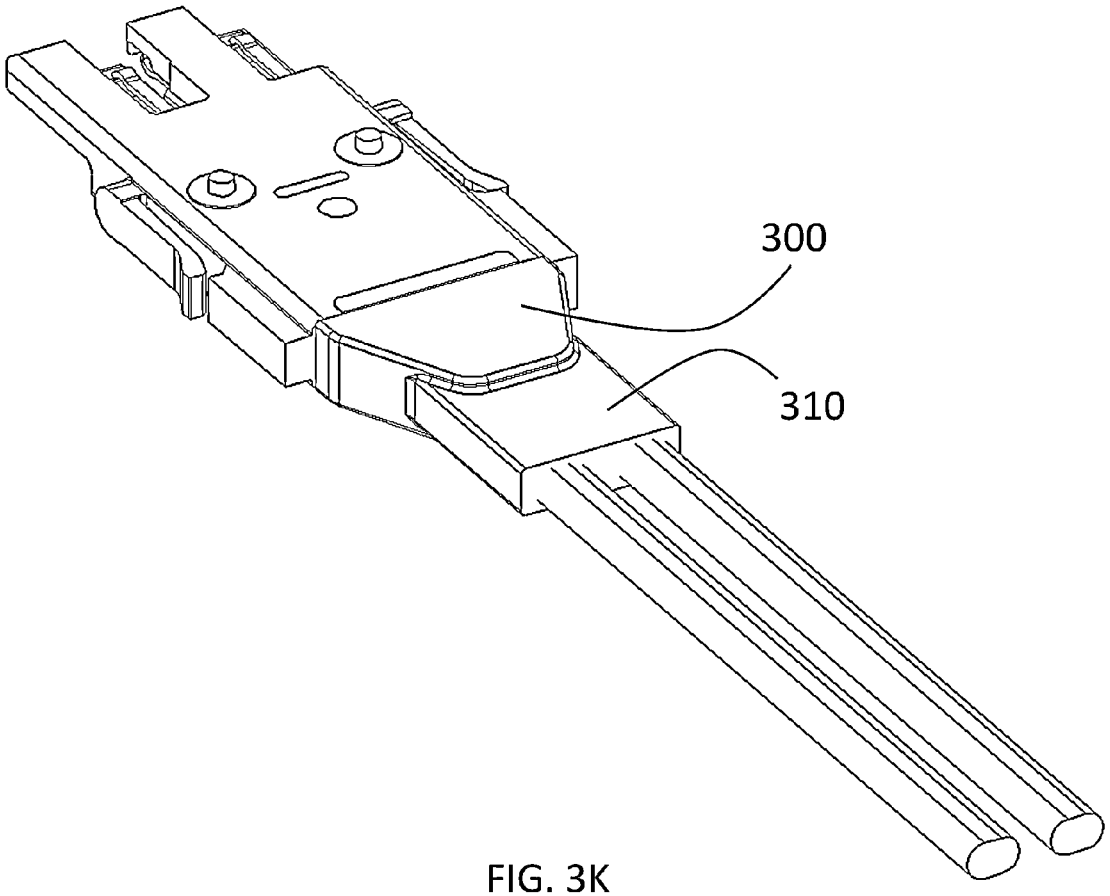


FIG. 3K

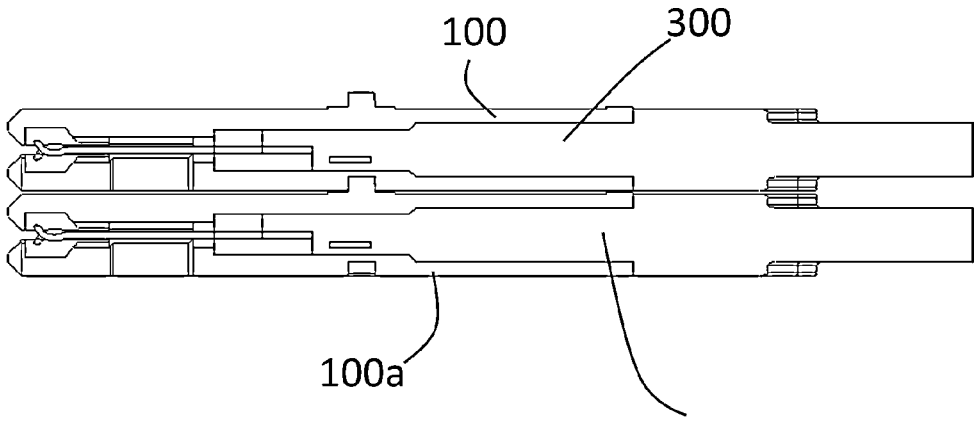


FIG. 3L

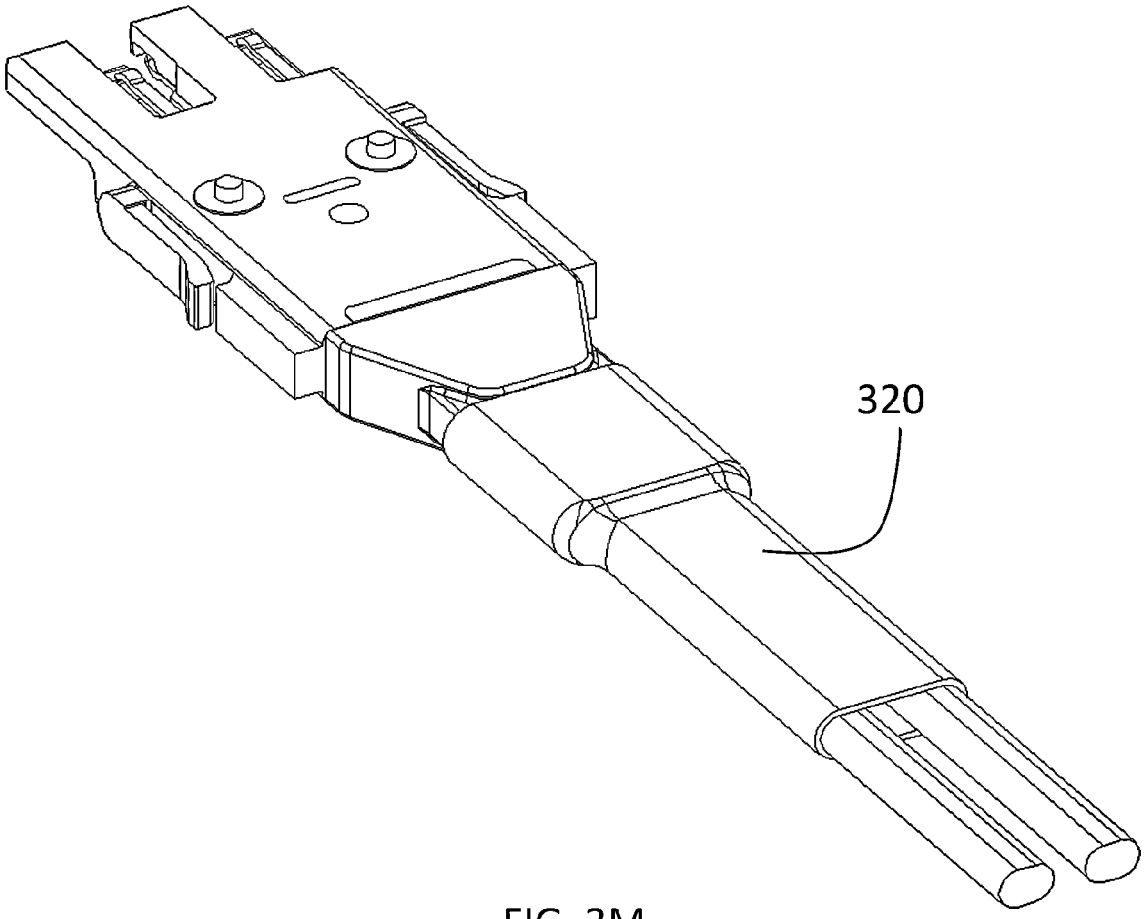
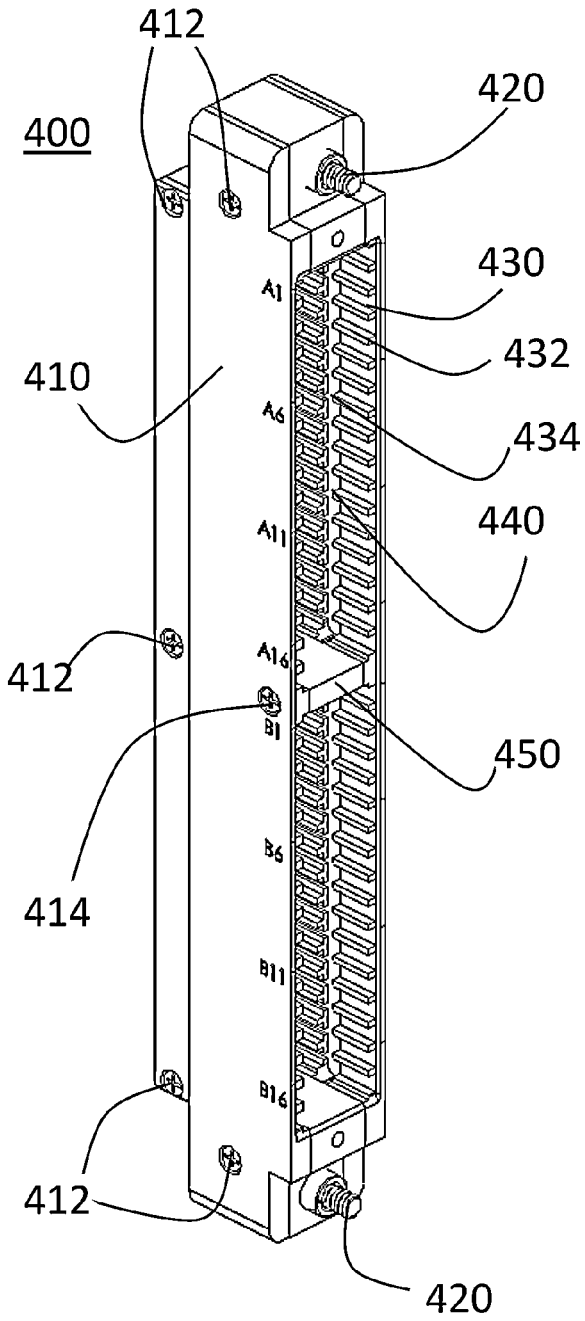


FIG. 3M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420
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A1
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A16
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B11
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FIG. 4A

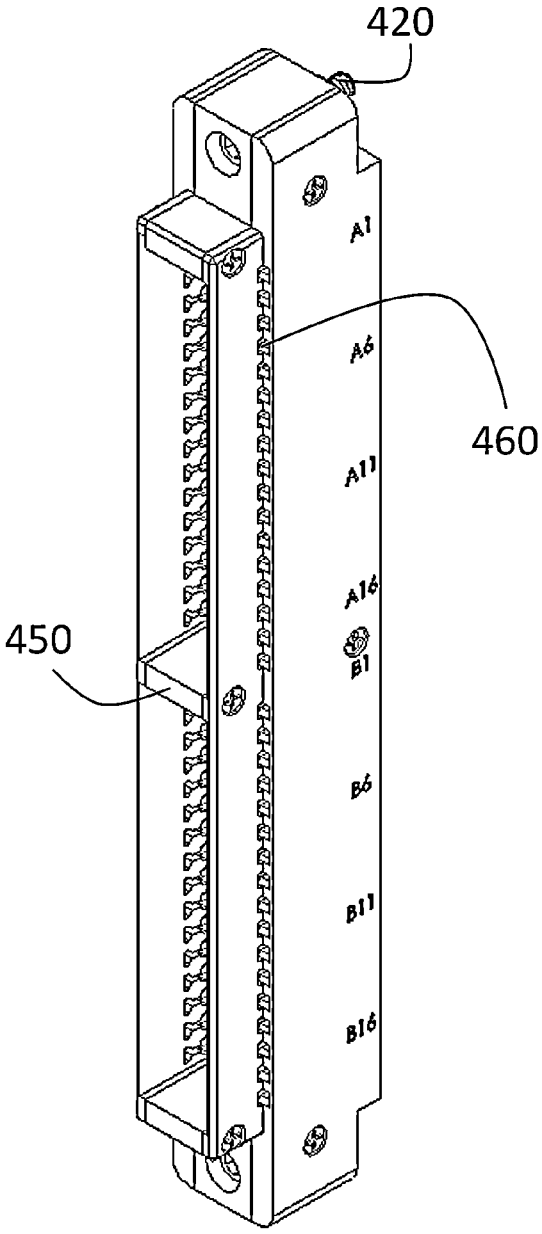
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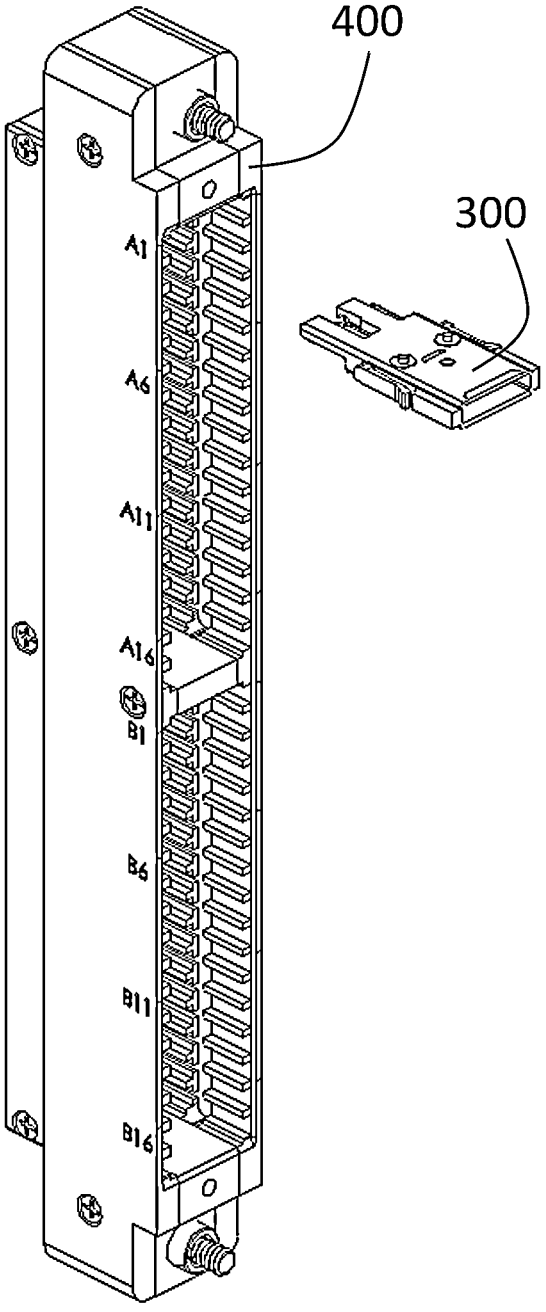
FIG. 4B



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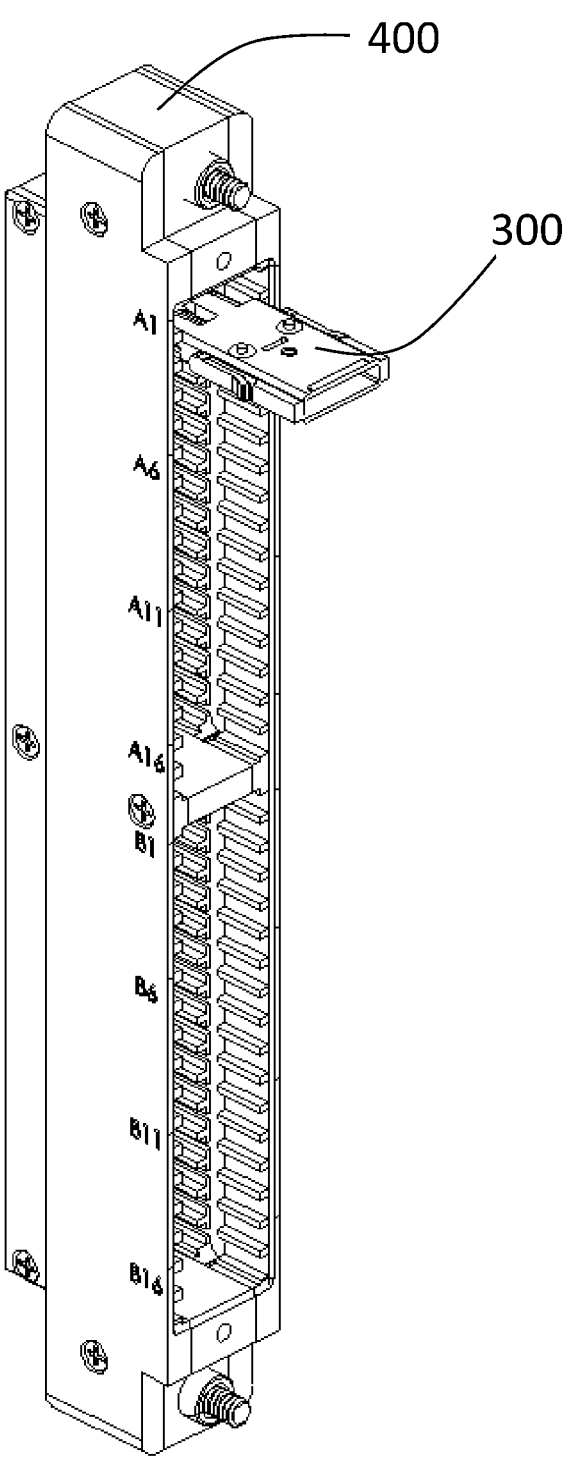
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B1
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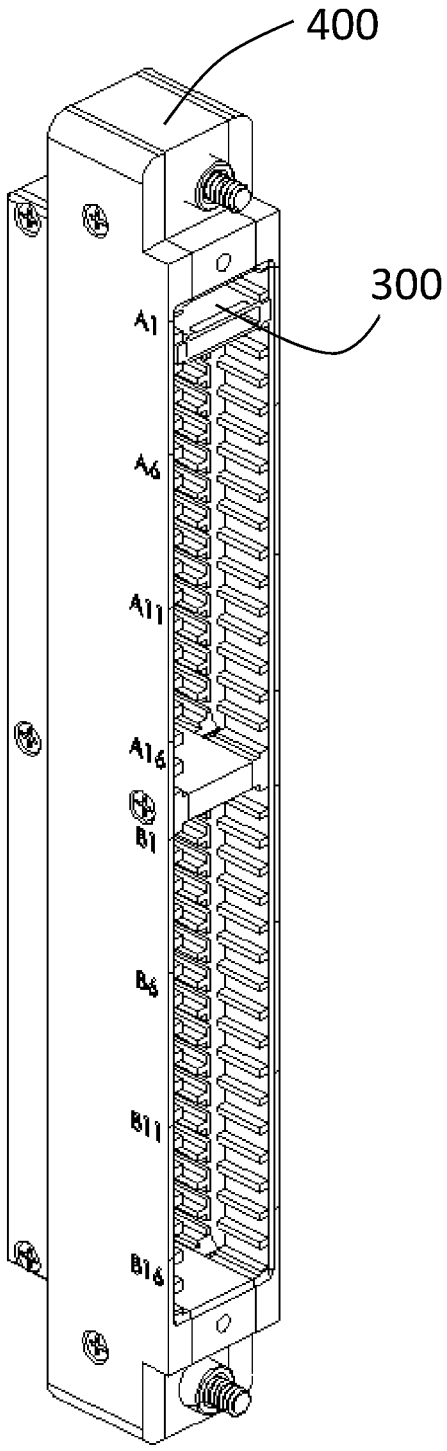
FIG. 4D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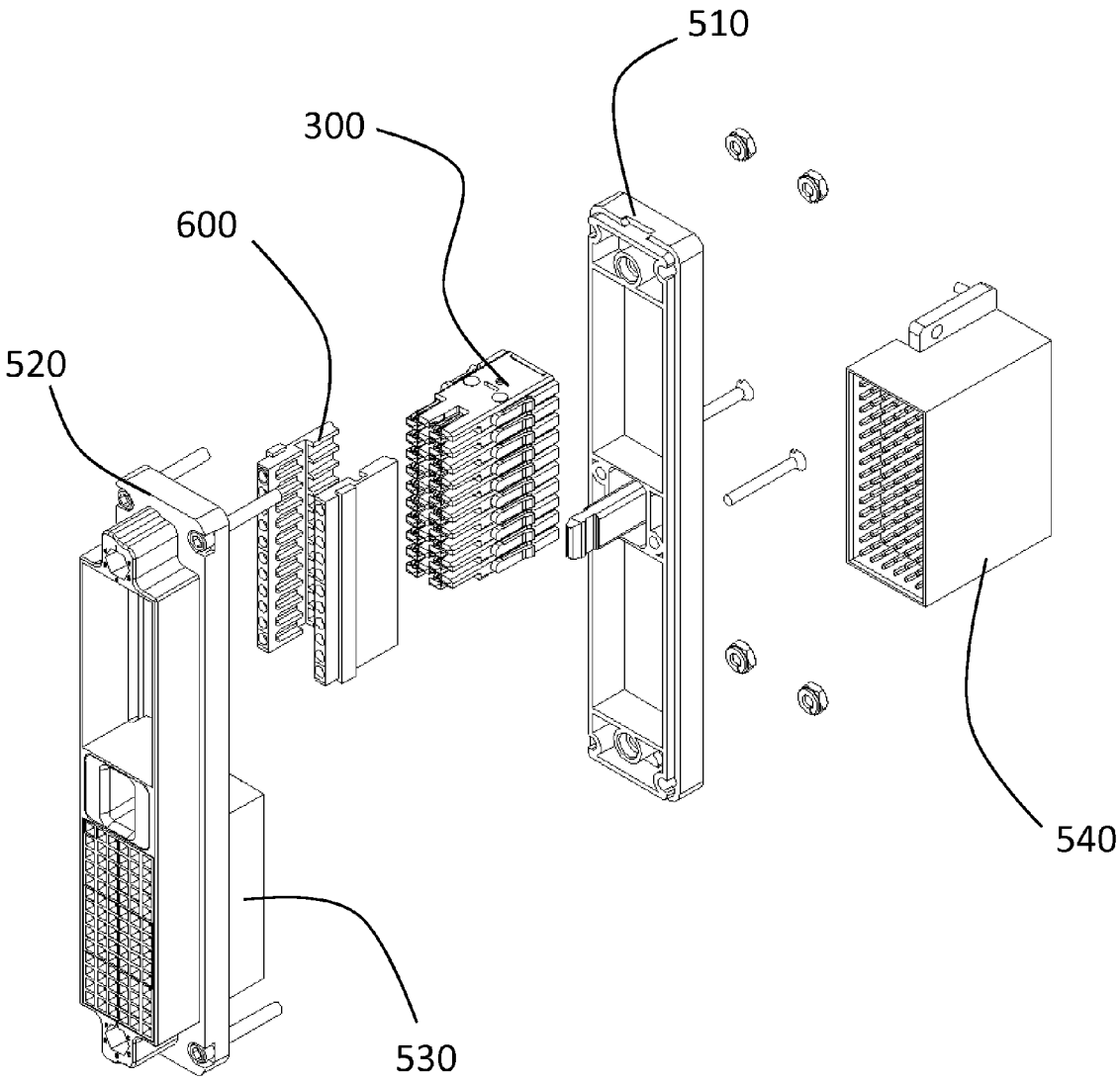

FIG. 5A

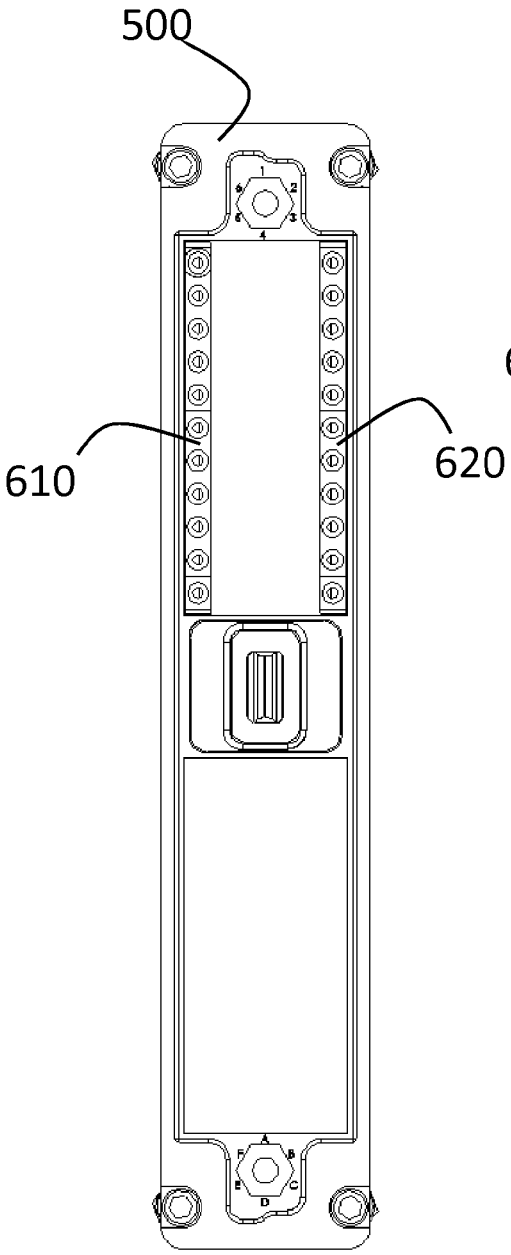

FIG. 5B

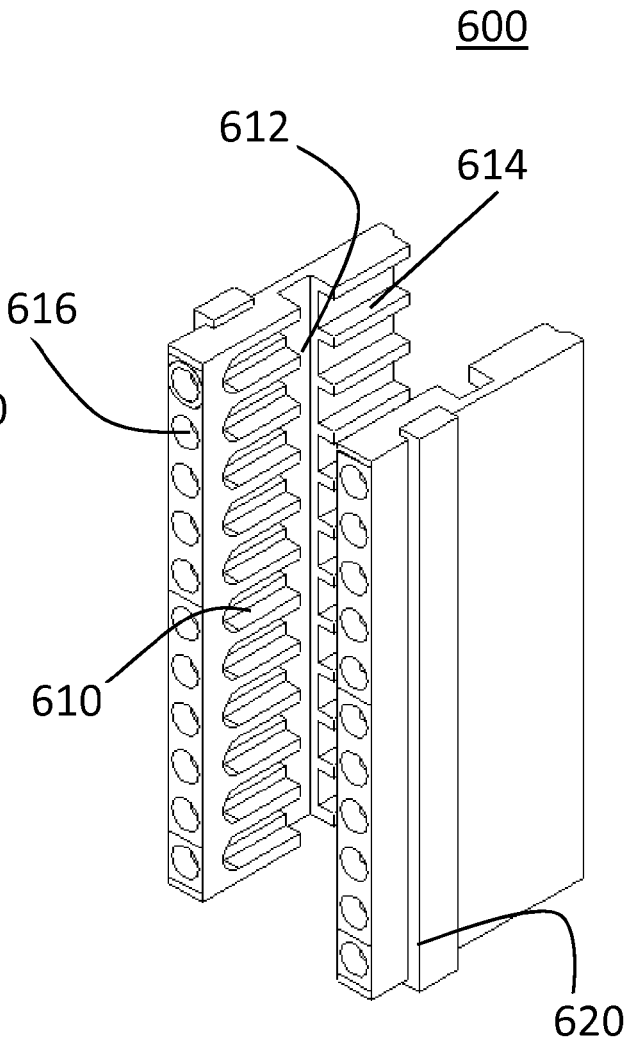

FIG. 6

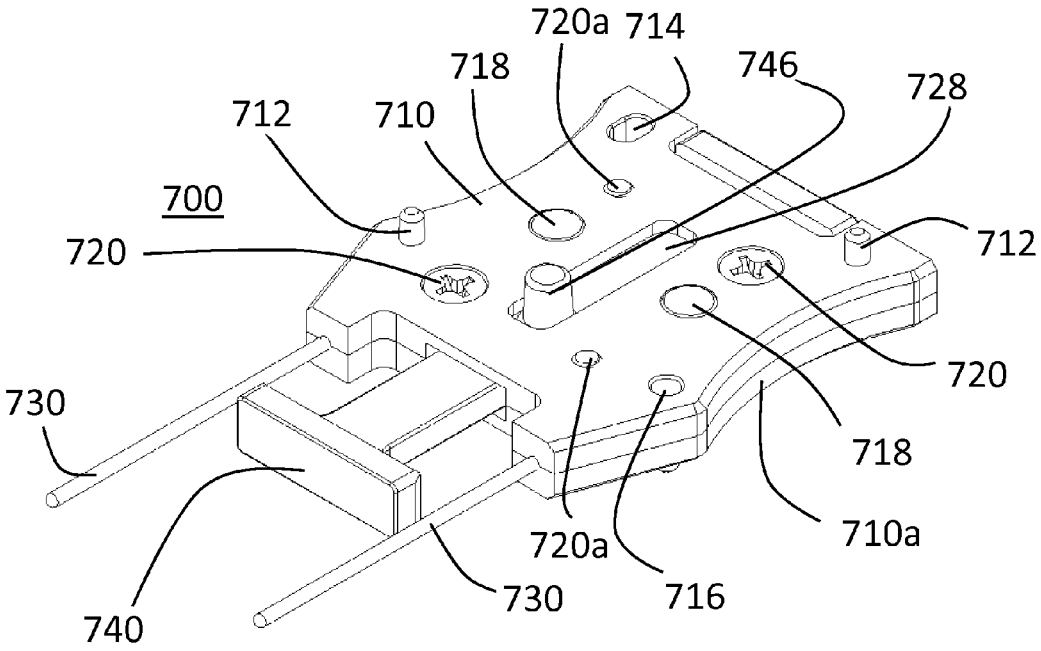
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FIG. 7A

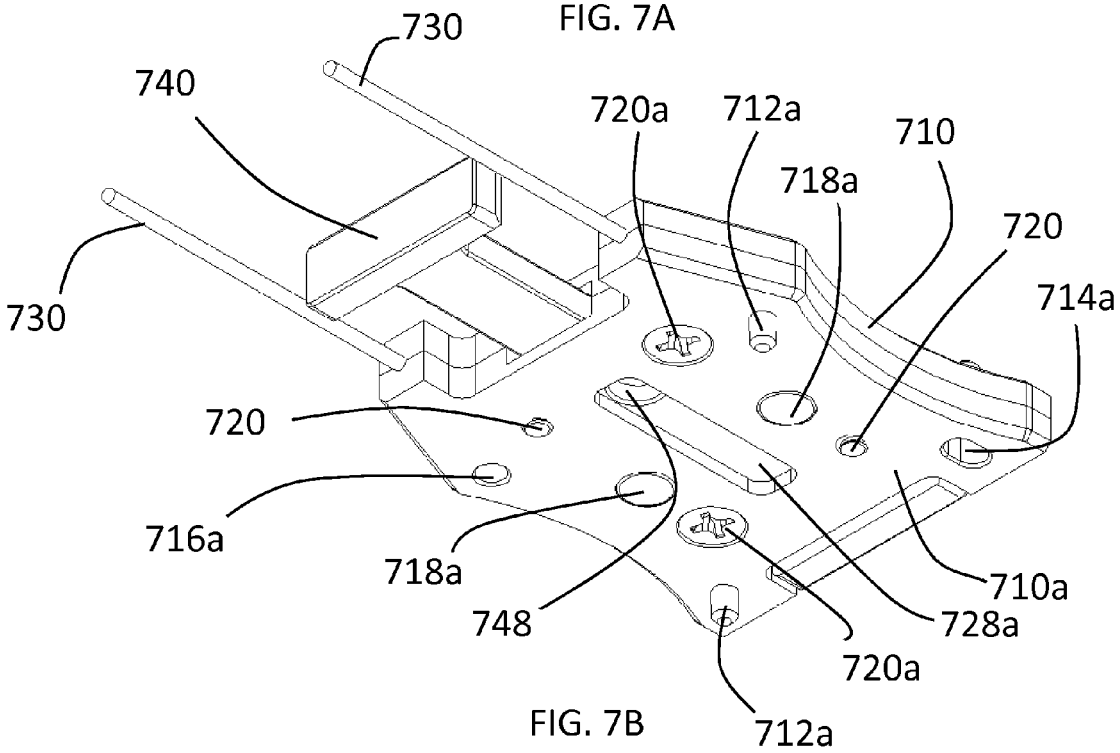
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FIG. 7B

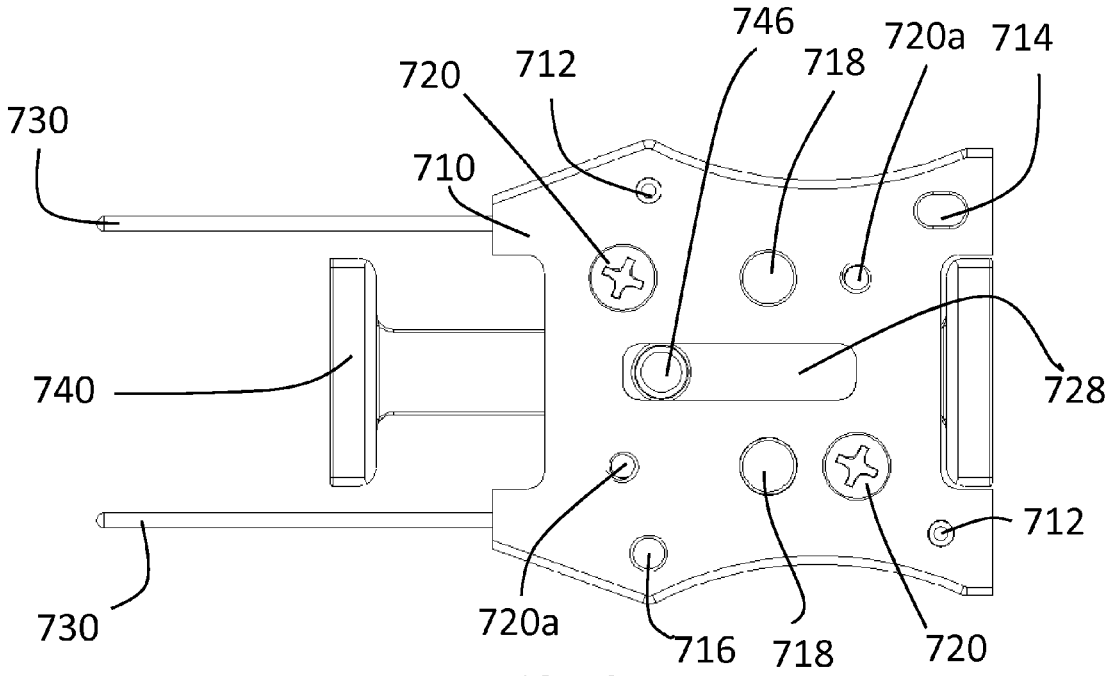


FIG. 7C

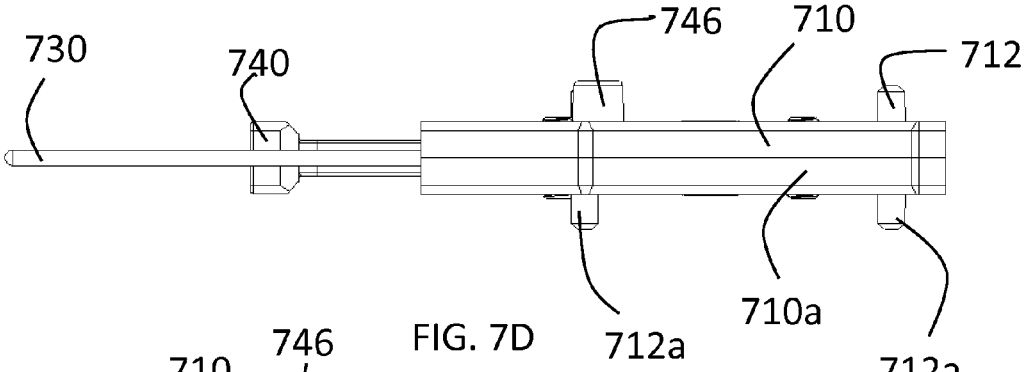


FIG. 7D

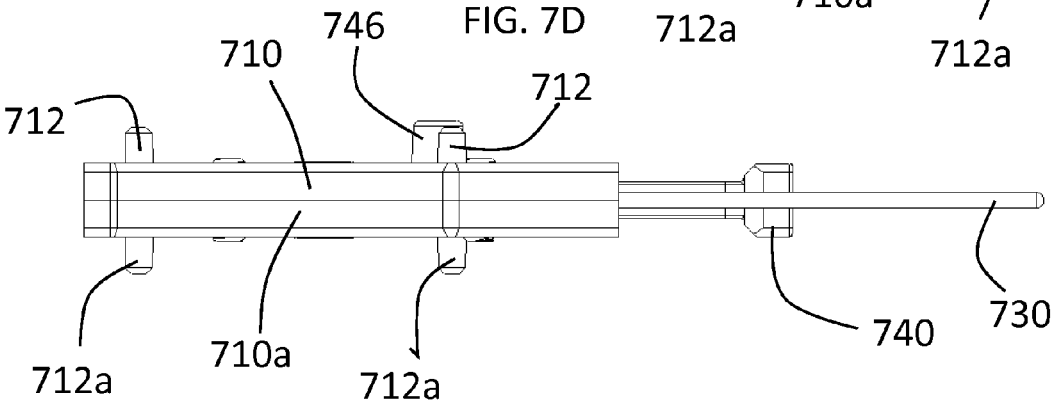


FIG. 7E

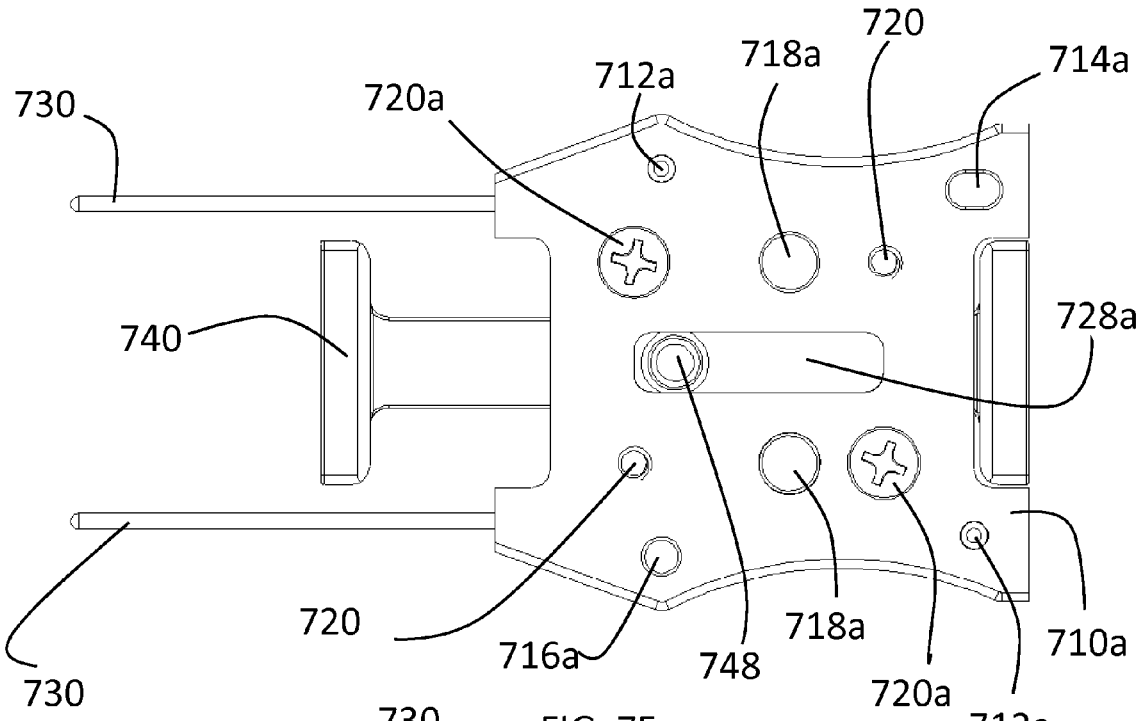


FIG. 7F

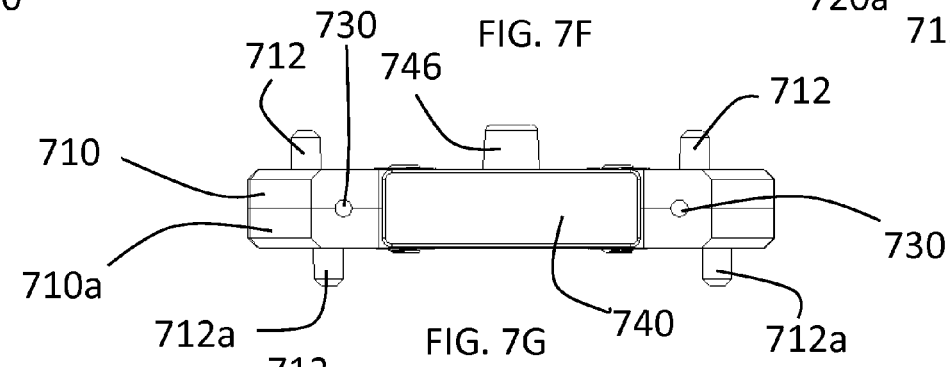


FIG. 7G

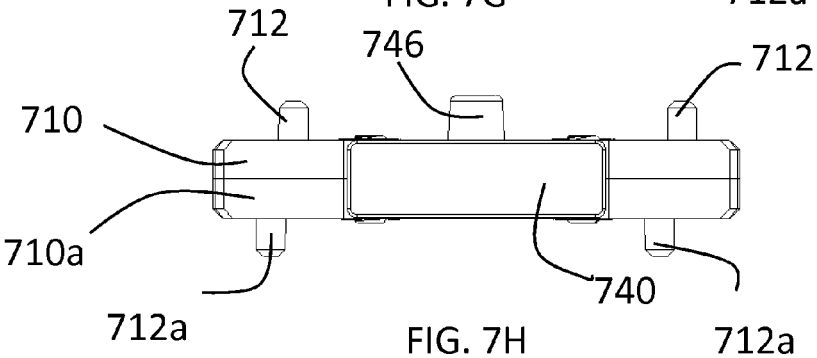


FIG. 7H

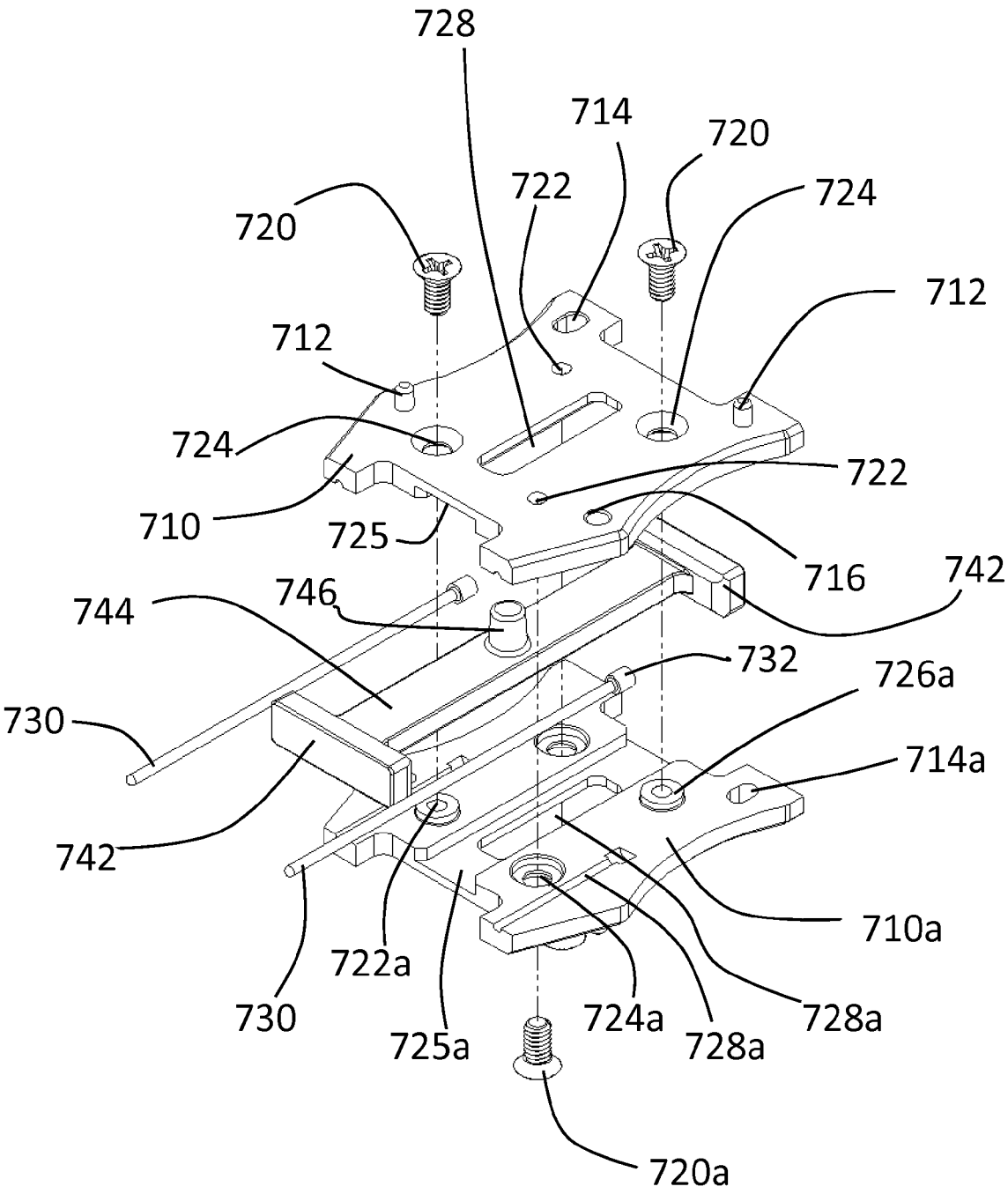

728
714
720
722
724
720
712
712
724
722
710
725
716
742
744
746
732
726a
730
714a
742
710a
722a
730
725a
724a
728a
728a
720a

FIG. 7I

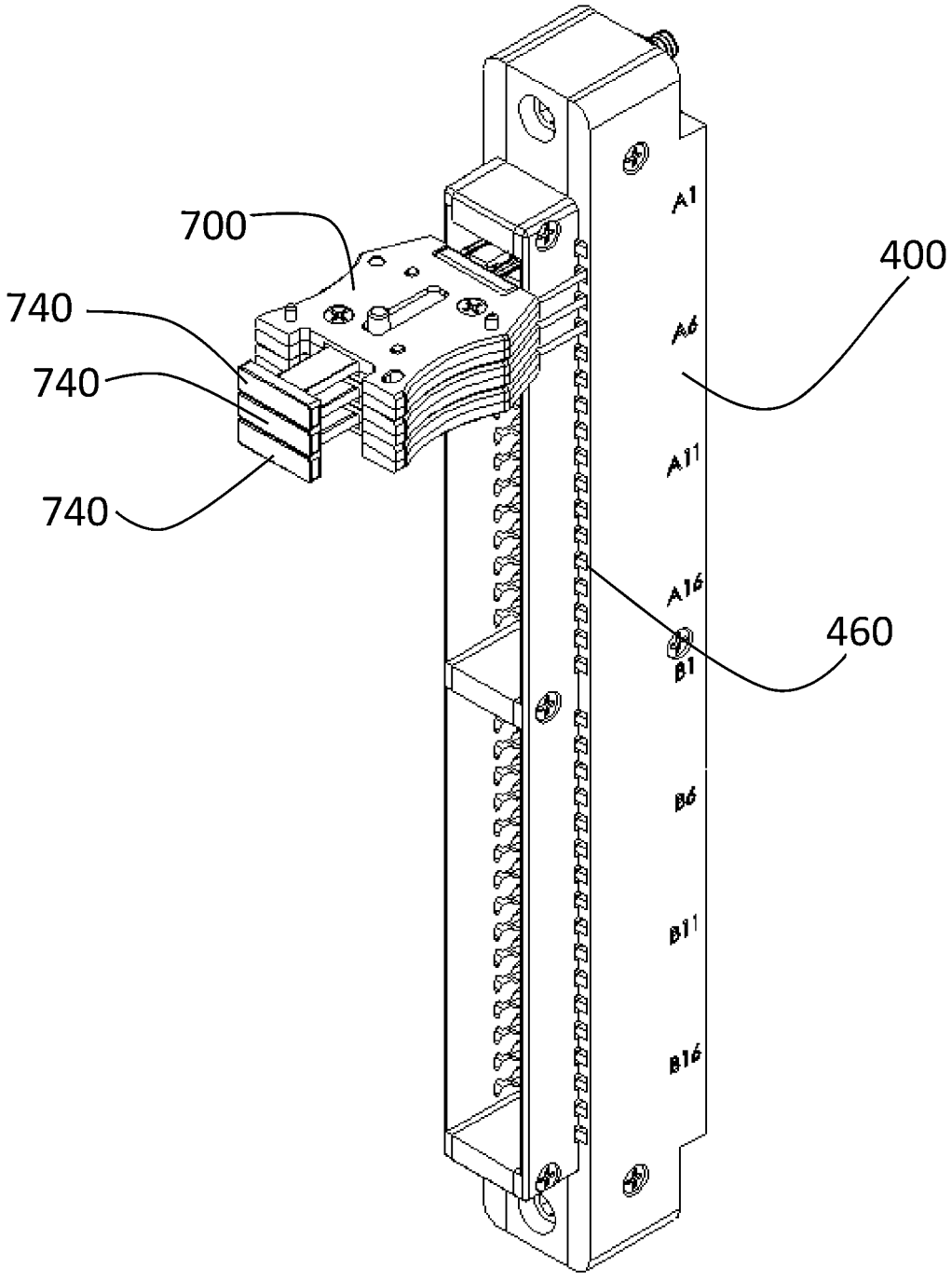


FIG. 8A

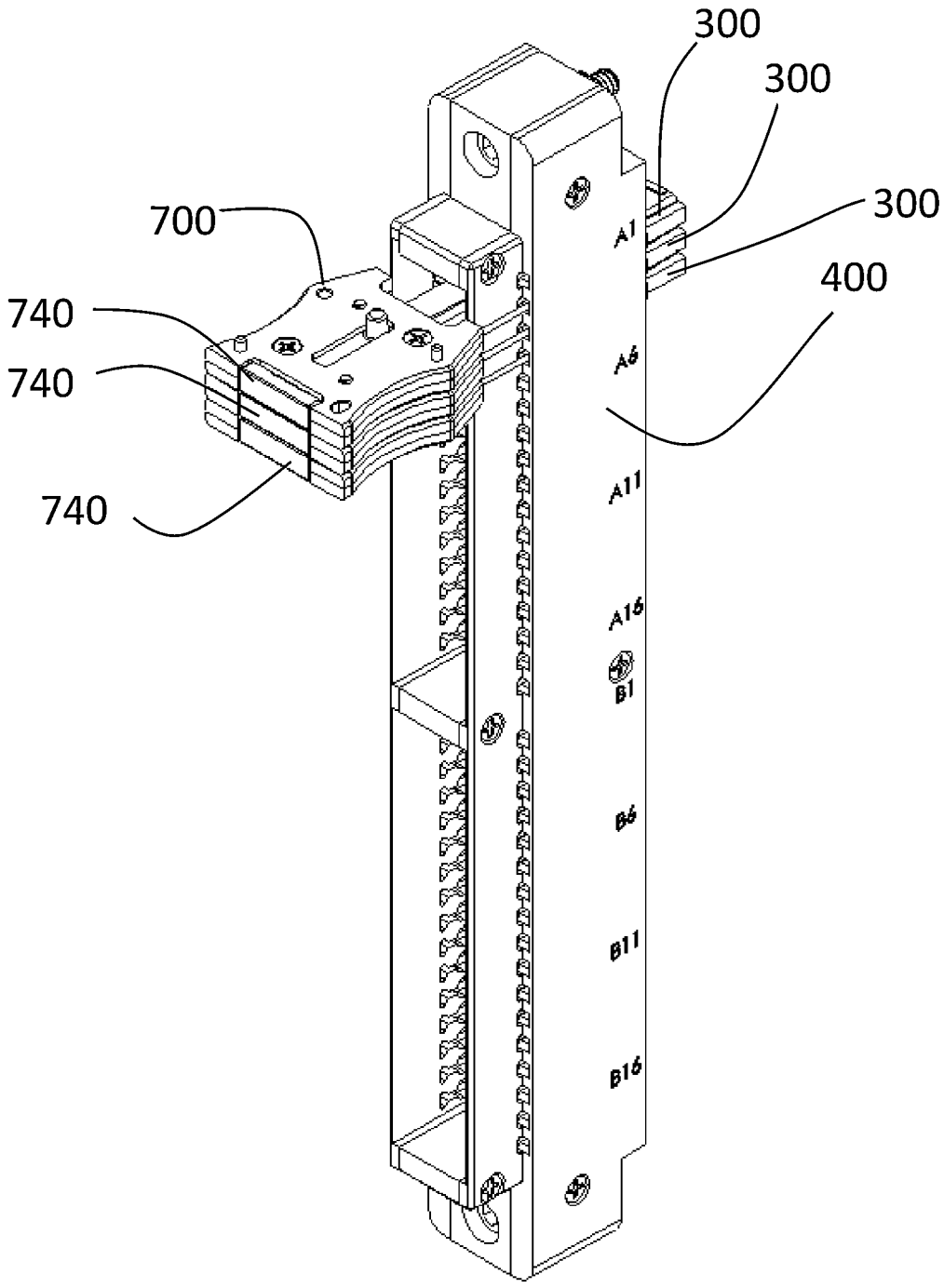


FIG. 8B

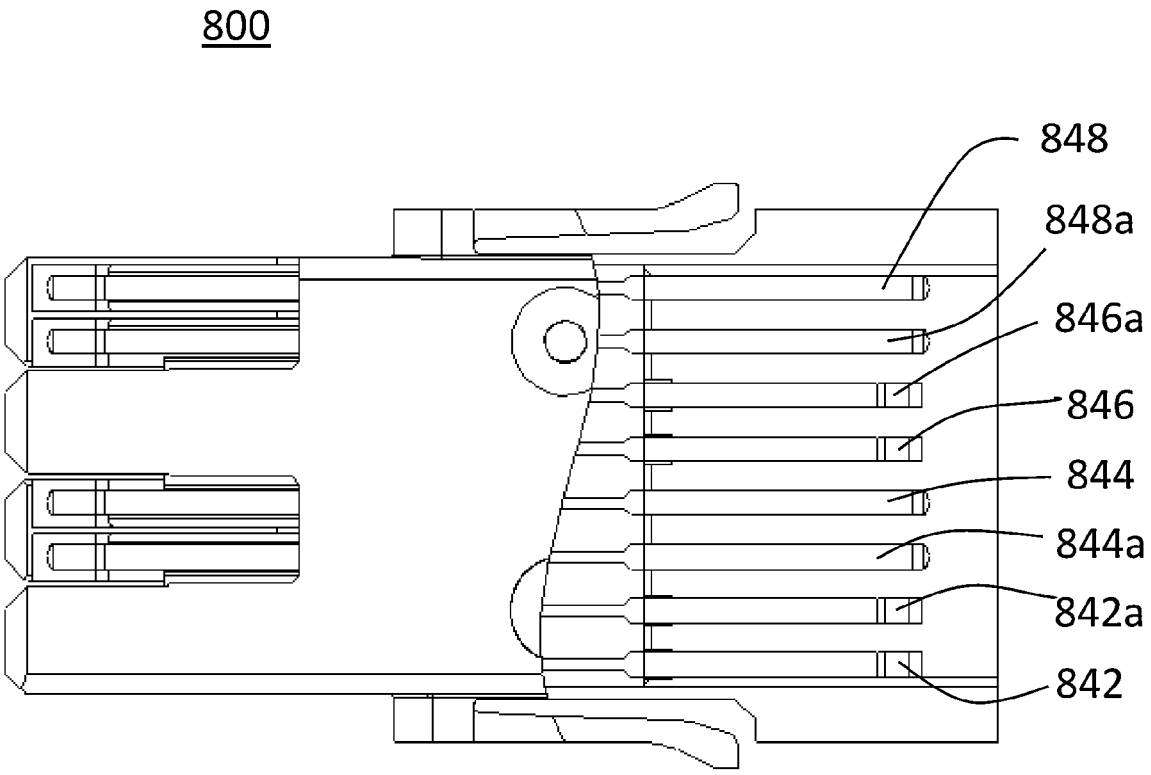


FIG. 9A

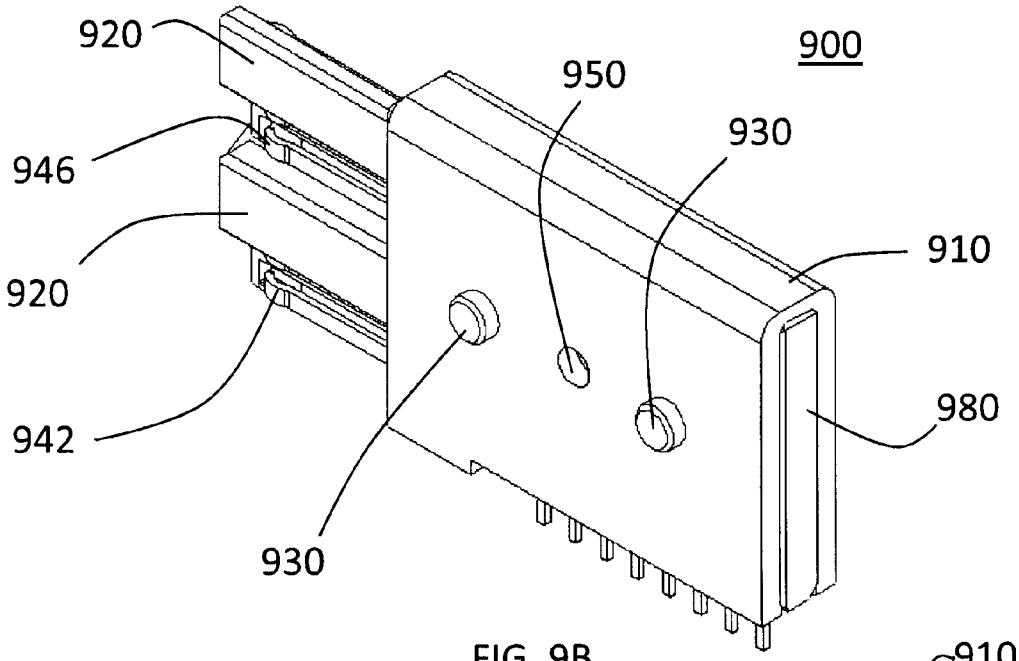
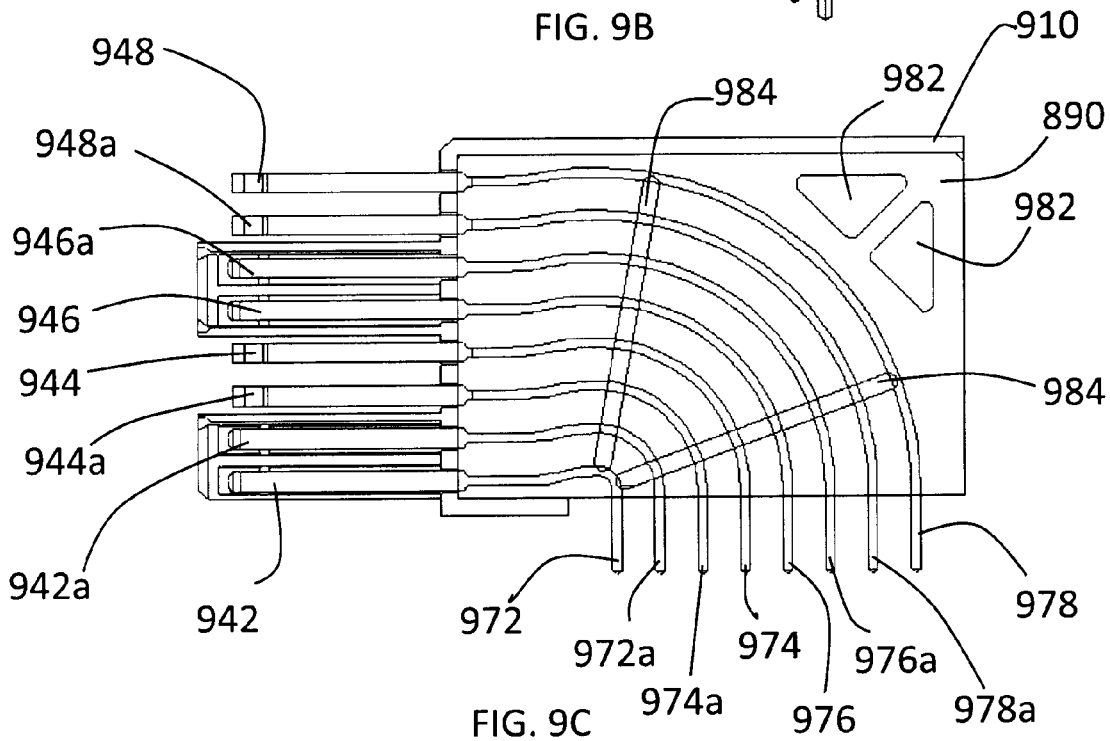

920
900
950
930
946
910
920
980
942
930

FIG. 9B


948
910
984
982
890
948a
982
946a
946
984
944
944a
942a
942
972
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972a
974
976a
974a
976
978a

FIG. 9C

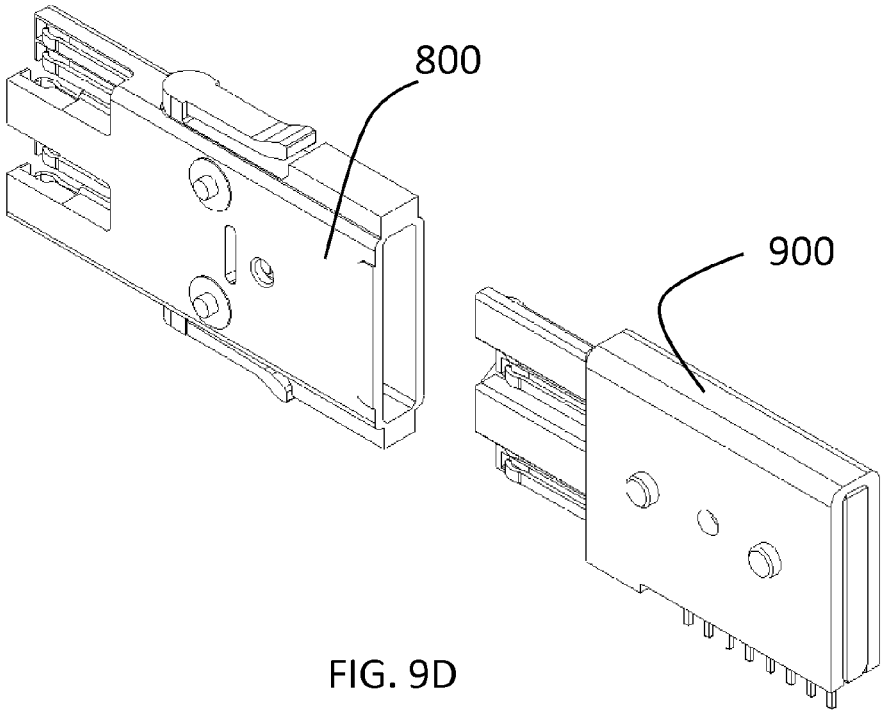

FIG. 9D

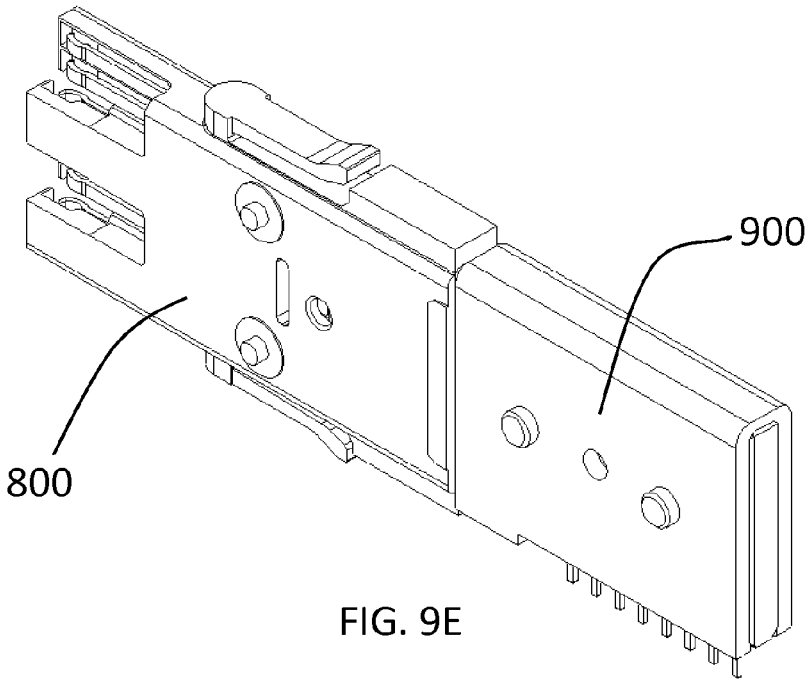

FIG. 9E

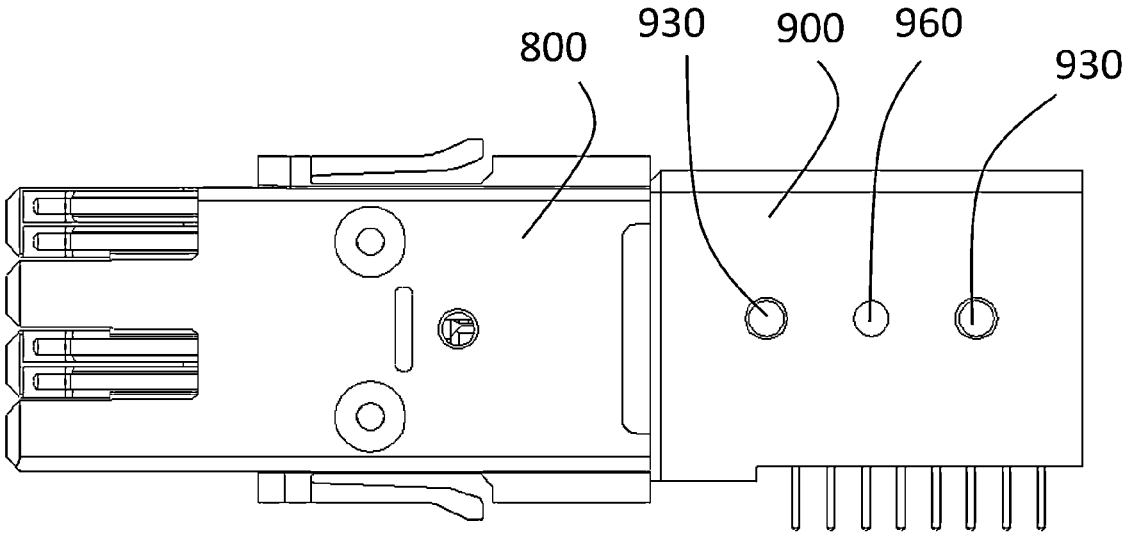

FIG. 9F

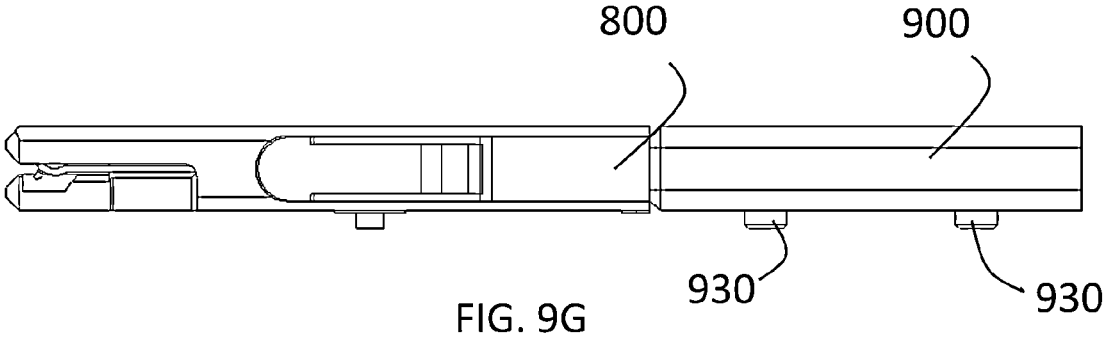

FIG. 9G

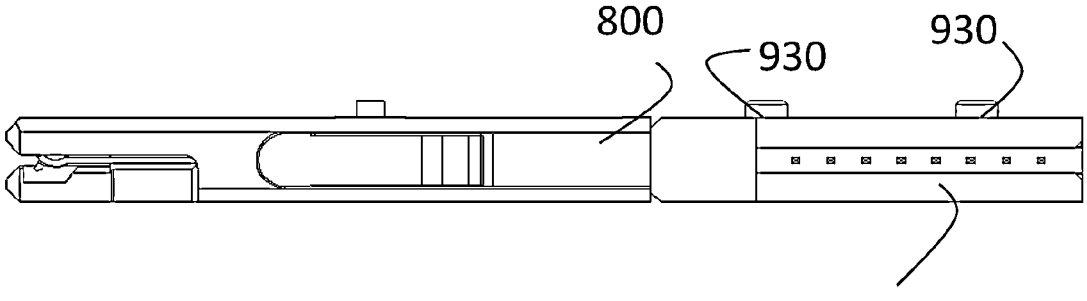

FIG. 9H

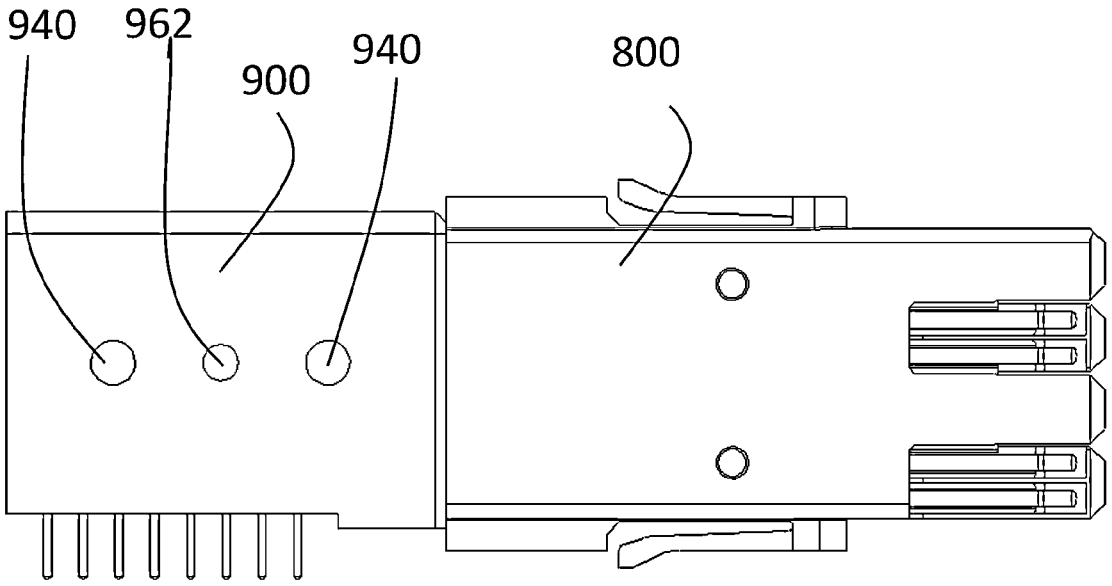

FIG. 9I

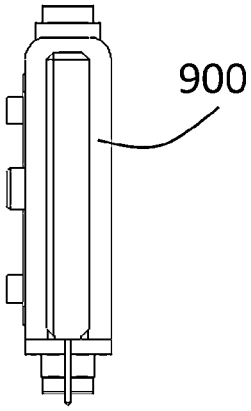

FIG. 9J

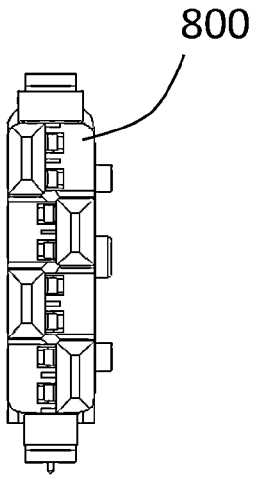

FIG. 9K

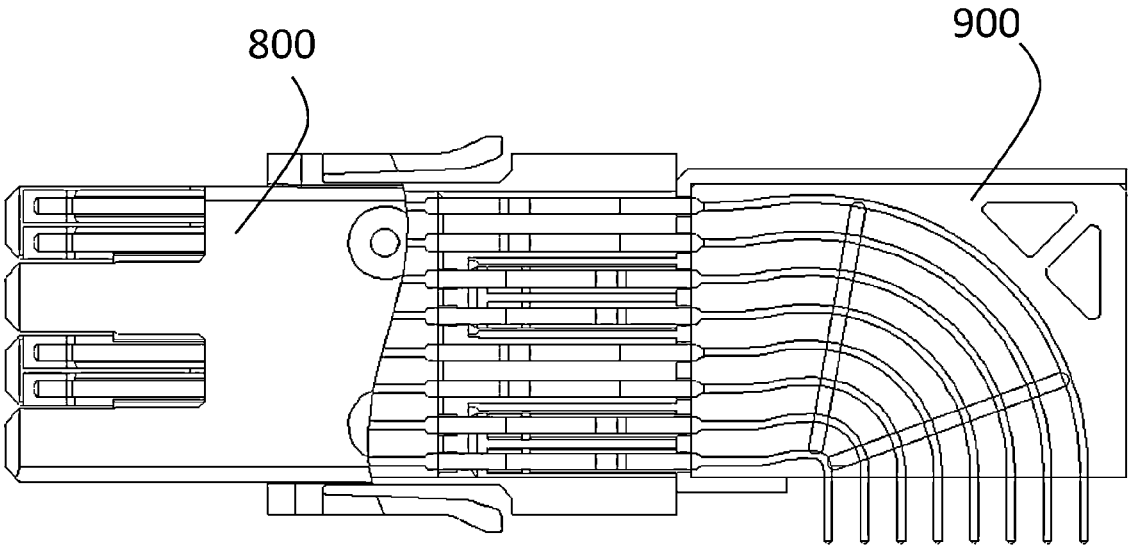

FIG. 9L

HIGH SPEED DATA MODULE FOR HIGH LIFE CYCLE INTERCONNECT DEVICE

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims the benefit of the filing dates of U.S. Provisional Patent Application Ser. No. 61/882,091 filed by the present inventors on Sep. 25, 2013 and U.S. Provisional Patent Application Ser. No. 61/901,723 filed by the present inventors on Nov. 8, 2013.

The aforementioned provisional patent applications are hereby incorporated by reference in their entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

None.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to high-speed data contacts, and more particularly, high speed contact sets or modules for use with high life-cycle or mass interconnect devices.

2. Brief Description of the Related Art

A variety of high speed data contacts have been developed and used along with various modules for housing such high speed data contacts. Examples include those disclosed in U.S. Patent Application Publication No. 2013/0102199, entitled "Hermaphroditic Interconnect System," U.S. Patent Application Publication No. 2011/0177699 entitled "Backplane Cable Interconnection," U.S. Patent Application Publication No. 2010/0248522 entitled "Electrical Cable Connection Latch System" and U.S. Pat. No. 7,316,579, entitled "Zero Insertion Force Cable Interface." Additional high speed data contact system are known, for example, as the "FCI Examax." While these prior high speed data contact systems had various advantages, none were specifically adapted for use in high life cycle systems designed to perform for thousands or tens of thousands of connection cycles or for mass interconnect systems.

A variety of high life cycle and mass interconnect devices for use with various contacts are known. One example of a conventional high life-cycle interconnect device or interface system is the mass interconnect device disclosed in U.S. Pat. No. 4,329,005, entitled "Slide Cam Mechanism for Positioning Test Adapter in Operative Relationship with a Receiver." Other prior art engagement systems include those disclosed in U.S. Pat. No. 5,966,023, U.S. Pat. No. 5,562,458, U.S. Pat. No. 7,297,014, U.S. Patent Application Publication No. 2010/0194417 and U.S. Pat. No. 8,348,693.

SUMMARY OF THE INVENTION

In a preferred embodiment, the present invention is a high speed data contact set. The high speed data contact set is hermaphroditic and may be used on both the receiver and test adapter sides of an interface. The high speed data contact set comprises an insert shroud having a hollow body for receiving a termination subassembly. The hollow body has a top, a bottom, a front, a rear, and first side and a second side. A plurality of protective arms extend from the front of the hollow body for protecting contact beams of a termination subassembly inserted into the insert shroud. Each protective arm has beveled edges at its distal end and an angled shoulder spaced from its distal end. The beveled edges provide a first stage of contact pre-alignment during engagement and the shoulder provides a second stage of contact pre-alignment during engagement. The insert shroud body further has a plurality of raised bosses on its top for engaging with a plurality of hollows in the bottom of an adjacent insert shroud. The terms "top" and "bottom" are used herein merely to identify different sides of the insert shroud and are not used to imply any particular orientation of the insert shroud. The insert shroud further has a latch on each of the first and second sides of the hollow body for locking the insert shroud into a module after insertion. The high speed data contact set may further comprise a first keying member on the first side of the hollow body and a second keying member on the second side of the hollow body. The insert shroud may further comprise a hole for injecting potting material.

A termination subassembly is inserted into the insert shroud. Potting material may be injected into the insert shroud around the termination subassembly through an opening or hole in the hollow body that may be of any shape. The termination subassembly has a plurality of pairs of contact beams, the contact beams in each pair being of the same orientation and the pairs of contact beams having alternating orientations. The termination subassembly may have a welded wire termination or a double beam contact termination.

Still other aspects, features, and advantages of the present invention are readily apparent from the following detailed description, simply by illustrating a preferable embodiments and implementations. The present invention is also capable of other and different embodiments and its several details can be modified in various obvious respects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and descriptions are to be regarded as illustrative in nature, and not as restrictive. Additional objects and advantages of the invention will be set forth in part in the description which follows and in part will be obvious from the description, or may be learned by practice of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention and the advantages thereof, reference is now made to the following description and the accompanying drawings, in which:

FIG. **1** is a perspective view of a shroud or housing for a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **2**A is a perspective view of a sheet of high speed contacts in accordance with a preferred embodiment of the present invention.

FIG. **2**B is a perspective view of an termination subassembly for a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **2**C is a perspective view of a wired termination subassembly for a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **3**A is a perspective view of an termination subassembly and housing for a high speed data contact set in accordance with a preferred embodiment of the present invention prior to the termination subassembly being inserted into the housing.

FIG. **3**B is a perspective view of a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **3**C is a perspective view of a high speed data contact set in accordance with a preferred embodiment of the present

invention with one protective arm of the housing cut away to illustrate the positioning of the termination subassembly within the housing.

FIG. **3**D is a top view of a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **3**E is a first side view of a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **3**F is a front view of a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **3**G is a bottom view of a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **3**H is a cross-sectional view of a stacked pair of high speed data contact sets in accordance with a preferred embodiment of the present invention prior to injection of potting material into the housing.

FIG. **3**J is a perspective view of a wired high speed data contact set in accordance with a preferred embodiment of the present invention prior to injection of potting material into the housing.

FIG. **3**K is a perspective view of a wired high speed data contact set in accordance with a preferred embodiment of the present invention after injection of potting material into the housing.

FIG. **3**L is a cross-sectional view of a stacked pair of high speed data contact sets in accordance with a preferred embodiment of the present invention after injection of potting material into the housing.

FIG. **3**M is a perspective view of a completed assembly of a wired high speed data contact set in accordance with a preferred embodiment of the present invention after injection of potting material into the housing.

FIG. **4**A is a rear perspective view of an interface module adapted to accommodate a high speed data contact set in accordance with a preferred embodiment of the present invention.

FIG. **4**B is a front perspective view of an interface module adapted to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention.

FIG. **4**C is a rear perspective view of an interface module adapted to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention with a high speed data contact set aligned for insertion into the interface module.

FIG. **4**D is a rear perspective view of an interface module adapted to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention with a high speed data contact partially inserted into the interface module.

FIG. **4**E is a rear perspective view of an interface module adapted to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention with a high speed data contact fully inserted into the interface module.

FIG. **5**A is an assembly drawings of a receiver of an interface system adapted to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention.

FIG. **5**B is a front view of an interface receiver frame adapted to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention.

FIG. **6** is a perspective view of an adapter insert for an interface receiver frame to accommodate a plurality of high speed data contact sets in accordance with a preferred embodiment of the present invention.

FIG. **7**A is a top perspective view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**B is a bottom perspective view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**C is a top view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**D is a first side view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**E is a second side view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**F is a bottom view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**G is a front view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**H is a rear view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **7**I is an assembly view of an extraction tool for extracting a high speed data contact set from a module in accordance with a preferred embodiment of the present invention.

FIG. **8**A is a perspective view of a plurality of extraction tools aligned to extract a plurality of high speed data contact sets from an interface module in accordance with a preferred embodiment of the present invention.

FIG. **8**B is a perspective view of a plurality of extraction tools aligned to extract a plurality of high speed data contact sets from an interface module in accordance with a preferred embodiment of the present invention with the high speed data contact sets disengaged from the module.

FIG. **9**A is a partial top cross-sectional view of an alternative embodiment of a high speed data contact set for use with a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**B is a perspective view of a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**C is a cross-sectional view of a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**D is a perspective view of an alternative embodiment of a high speed data contact set aligned for connection with a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**E is a perspective view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**F is a top view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**G is a first side view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**H is a second side view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**I is a bottom view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**J is a rear view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**K is a front view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

FIG. **9**L is a partial cross-sectional view of an alternative embodiment of a high speed data contact set connected to a right angle high speed contact set in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a preferred embodiment the present invention is a high speed data contact set for use with high life cycle or mass interconnect systems. The high speed data contact set, sometimes referred to as a chiclet, of a preferred embodiment of the present invention has a housing or shroud **100** that includes multi-stage lead-in features and controlled float to pre-align contacts during engagement and thereby extends the cycle life of the contacts. The housing, shown in FIG. **1**, is formed, for example, from a non-conductive material such as plastic. The housing **100** has a hollow body **110** having a plurality of protective arms **120***a*, **120***b*, **120***c*, and **120***d* extending from the distal portion of the body **110**. The end of each protective arm **120***a*, **120***b*, **120***c*, and **120***d* has one or more beveled or angles edges **122** for providing a first stage of pre-alignment of contacts during engagement, for example, with another chiclet. On each side of each protective arm there is an angled shoulder **124** for providing a second stage of pre-alignment of contacts. The housing body **110** has a latch **130** on each side for holding the latch in a module after insertion. The latches **130** are biased away from the body **110** and have angled portions **132** extending away from the hollow body **110**. The portions **132** may include beveled or angled corners and edges to prevent snagging and/or breakage when the shroud is removed from a module. The latches make the insert shrouds individually removable from a module of a receiver or test adapter frame. Also on each side, the housing body **110** has keying members **172**, **174**. The two module keying members **172** and **174** are of different sizes, as shown in FIG. **3**F, thereby allowing insertion of the chiclet into a module in only one orientation, thereby preventing human errors in setting up an interface system. On top of the housing body **110** are two raised bosses **140** for providing alignment of the housing body **110** with an adjacent housing body when a plurality of chiclets are stacked together. At the base of each raised boss **140** is an annular spacing ridge **142**. The top of the housing body **110** further has a hole **150** through which potting material may be injected. Also on the top of the housing body **110** is a slot **160** that may be used, for example, to release another connector that has been inserted into the rear of the insert shroud, such as is shown in FIGS. **9**A-**9**L. At the proximal end, the housing body **110** has a ridge or raised portion **180** corresponding to the height of the annular ridges **142**.

The high speed data contact set has a termination subassembly **200**, shown in FIG. **2**B. A sheet **210** of contacts are formed by known means. On the sheet, the contacts are formed in a load balanced alternating two up/two down pattern. As will be described later, this pattern allows the high speed data contact set to be hermaphroditic such that the same high speed data contact set or chiclet may be used on both the receiver side and test adapter side of an interface and can connect to one another. A set of eight contacts **242**, **242***a*, **244***a*, **244**, **246**, **246***a*, **248***a*, **248** is cut from the sheet **210**, the set having the two up two down pattern of contacts. The eight contact beams in the set initially are connected to one another by shield **220**. The eight contact beams are in a row (wafer shape) and can carry differential signal pairs at speeds of 10 Gigabits per second. A termination subassembly body **230** is molded on and around the contacts as shown in FIG. **2**B. The termination subassembly body is formed of a non-conductive or insulating material such as plastic. After molding of the insert body assembly **230** onto the contact set four of the contacts, **242***a*, **244***a*, **246***a* and **248***a*, are disconnected from the shield **220**. Contacts **242**, **244**, **246** and **248** remain connected to one another by the shield by cutting the beams adjacent the shield. An exemplary wiring of the termination subassembly is shown in FIG. **2**C. Contacts **242***a* and **244***a* are direct welded to wires **252**, **254** in bundle **250** and contacts **246***a* and **248***a* are direct welded to wires **262**, **264** in bundle **260**. The direct welded termination allows for optimum electrical performance enabling high data rates. The high data rates are achieved because the direct welding fused the standard industry cable conductor material directly to the contact beams without introduction of another material such as solder. While the direct welding is preferred, other types of connected besides direct welding may be used. The termination subassembly is compatible with most standard industry connectors and cables, including but not limited to USB, HDMI, SATA, RJ45, Gigabit Ethernet, DVI and QSFP.

In FIG. **3**A, the termination subassembly **200** is shown aligned with a housing **100** for insertion of the termination subassembly **200** into the housing **100** to form the high speed contact data set. As shown in FIG. **3**A, the termination subassembly, for example, may have beveled corners on the top or bottom to align with corresponding structures on the interior of the housing **100** to ensure that the termination subassembly is inserted into the housing in the proper orientation. The high speed data contact set **300** is shown in FIGS. **3**B-**3**H. The protective arms **120***a*, **120***b*, **120***c* and **120***d* each cover one side of a pair of contacts. In this manner the shroud protects the contact beams. Viewed from the top as shown in FIG. **3**D, contact pairs **244***a*, **244** and **248***a*, **248** are exposed while contact pairs **242**, **242***a* and **246**, **246***a* are respectively covered by protective arms **120***a* and **120***c*. Viewed from the bottom as shown in FIG. **3**G, contact pairs **242**, **242***a* and **246**, **246***a* are exposed while contact pairs **244***a*, **244** and **248***a*, **248** are covered by protective arms **120***b* and **120***d* respectively. A shown in FIG. **3**G, the bottom side of the housing body **110** has holes or depressions **190** for receiving raised bosses **140** when two or more high speed data contact sets are stacked. The raised bosses **140** and accommodating holes or hollows **190** allow for the chiclets to be stacked and by having two raised bosses prevents rotation of the chiclets relative to one another, thereby allowing a stacked assembly of chiclets to be inserted into a module simultaneously with ease. An exemplary stack of two high speed data contact sets **100** and **100***a* are shown in FIG. **3**H in cross-section form to illustrate the

placement of raised bosses **140***a* extending from the top of high speed data contact set **100***a* into the holes or depressions **190** in the bottom of high speed data contact set **100**. When a stack of a plurality of high speed data contact sets is being assembled, the raised bosses **140** on the top of the top-most high speed data contact set may be removed, such as by sanding, to allow other stacks of high speed data contact sets or other types of contacts to be installed in a module adjacent the stack of high speed data module contact sets.

A high speed data contact set of the present invention is shown in FIG. **3**J with a wired termination subassembly inserted into a housing **100**. Potting material is injected into the hole **150** in the housing body **110** to surround the termination subassembly inside the housing body **110** and to fill open space within the housing body **110**. The potting material **300** extends outside the housing body **110** to form a neck **310**, which protects the connections between the wire bundles **250**, **260** and the contacts in the termination subassembly. FIG. **3**L is a cross-section illustrating the interior of high speed contact data sets **100** and **100***a* in a stacked configuration with potting material **300** and **300***a* with the respective housing bodies. After the potting material **300** is in place, a protective material **320** is placed around the potting material extending out of the housing body **100** and the wire bundles **250**, **260**.

Insertion of a chiclet into a module will be described with reference to FIGS. **4**A-**4**E. A module adapted to house a plurality of high speed data contact sets is shown in FIGS. **4**A and **4**B. The module has a frame **410** and a plurality of screws **412** connecting different portions of the module **400** together. At each end of the module frame **410** is a screw **420** for connecting the module to an interface receiver frame or interface test adapter frame. The module **400** additionally has a support member **450** connected to the module frame **410** by screws **414**. In the interior of the module, there are a plurality of slots **430** for receiving high speed data contact sets. The slots **430** are defined by a plurality of ridges **432** on opposing sides of the module frame **410**. The slots on the two opposing sides of the module are of differing widths to accommodate the different sized keying elements **172**, **174** on the high speed data contact set housing **110**. On each of the two opposing sides of the module **400** there is a slot **434** running along the length of the module. The slot **434** may be formed by gaps in the ridges **432**. On the front face of the module on each side of the open portion into which the chiclets are inserted, there are a plurality of holes **460** with one hole on each side of the opening corresponding to each slot **430**. These holes **460** will be described below in connection with removal of chiclets from the module.

As shown in FIG. **4**C, a high speed data contact set **300** is aligned with one of the slots **430** in the module **400**. The high speed data contact set **300** is pushed into the slot **430**, as show in FIG. **4**D, until the latches **130** on the housing body **110** snap into the slot **434** running along the length of the module frame **410** as shown in FIG. **4**E. A plurality of high speed data contact sets, or chiclets, may be stacked as shown in FIGS. **3**H and **3**L and be inserted into a module **400** as a stack or group of chiclets.

The high speed data contact set can be used with various module form factors such that it can be used in a multitude of mass interconnect and high life-cycle engagement systems. An arrangement for the chiclets to be installed in a different type of interface device is shown in and described with respect to FIGS. **5**A and **5**B. A receiver frame **500** has a back half **510** and a front half **520** that can be connected to one another, for example with screws. The back half of the receiver frame **510** has an engagement mechanism **512**, such as, for example, the engagement mechanisms disclosed and described in U.S. Patent Application Publication No. 2010/0194417 or U.S. Pat. No. 8,348,693. The receiver frame **500** has a plurality of positions for inserting contacts of different types. In FIG. **5**A, an 84-position Quadrapaddle module insert **530** and an 84 position header **540** from Virginia Panel Corporation are shown in the lower portion of the receiver frame **500**. In the upper portion of the receiver frame **500** is a high speed insert module adapter **600** and a stack of high speed data contact sets or chiclets **300**. Different arrangements, such as the insert module adapter **600** in the lower half of the receiver frame **500** rather that the top, insert module adapters **600** in both the upper and lower portions, or the insert module adapter **600** in one of the upper or lower portions and some other type of adapter in the other portion will be apparent to those of skill in the art.

The insert module adapter **600** is shown in FIG. **6**. The insert module adapter **600** has a first side **610** and a second side **620**. Each side **610**, **620** has a plurality of slots **612** for receiving chiclets. The slots **612** on the first and second sides may be of different sizes to accommodate keying elements **172**, **174** on the chiclet housing body **110**. As with the prior module, the slots **612** may be formed from a plurality of ridges or may be grooves in the wall of the insert module adapter. Additionally, there is a groove or slot along the length of the insert module adapter—perpendicular to the slots **612**—for receiving the latches **132** of the chiclet housing body **110**.

To remove the high speed data module sets **300** from a module, an extraction tool is a used. The extraction tool removes a chiclet from the front of a module rather than the rear of the module, thereby allowing an operator to remove a chiclet from a module without first removing the module from the interface receiver or interface test adapter. An extraction tool **700** in accordance with the present invention is shown in FIGS. **7**A-**7**I. The extraction tool has upper and lower body portions **710** and **710***a*. The upper and lower body portions are identical to one another. Each body portion **710**, **710***a* has a pair of alignment posts **712**, **712***a* and alignment holes **714**, **716**, **714***a*, **716***a*. Additional holes **718**, **718***a* optionally may be included. The two body portions **710**, **710***a* are connected to one another with two pairs of screws **720**, **720***a*. The screws extend through holes **724**, **724***a* in the upper and lower body portions **710**, **710***a* and into holes **722**, **722***a* having interior raised portions **726***a* in the opposing body portion. When a plurality of extraction tools **700** are stacked to extract a plurality of chiclets from a module, the alignment posts **712** in one tool are placed into the holes **714**, **716** in an adjacent extraction tool. The hole **716** is slightly elongated compared to hole **714** to provide a limited amount of float when a plurality of extraction tools are stacked.

Mounted within the extraction tool are a pair of release pins **730** that extend from the front of the extraction tool **700**. Each release pin **730** has a portion that sits within a groove in the extraction tool body, as shown in FIG. **7**I. The proximal end of each release pin **730** has an enlarged portion **732** that sits within an enlarged groove portion and prevents the release pin **730** from sliding into or out of the extraction tool **700**. The release pins are replaceable. Slidably mounted within the extraction tool **700** is a plunger **740**. The plunger **740** has a shaft **744** with flat portions **742** at opposing ends. Extending from the middle portion of the shaft **744** is post **746** that extends upward through the slot **728** to extend out of the top of the extraction tool **700**. When the extraction tool **700** is fully assembled, the plunger **740** slides within the extraction tool. The post **746** is used by the operator of the extraction tool to move the plunger **740** between first and second positions. The bottom side of the plunger **740** has an opening **748** to a

cavity in the interior of the post **746**. When a plurality of extraction tools are stacked, the post **746** of one extraction tool extends through the slot **728***a* and opening **748** and into the cavity of the post **746** in the extraction tool just above it in the stack. With this configuration, an operator can move the plungers of a plurality of extractions tools simultaneously so as to remove a stack of a plurality of chiclets.

The use of the extraction tool is shown in FIGS. **8**A-**8**B. In FIG. **8**A, a stack of three extraction tools **700** is aligned with three chiclets in the module. The release pins **730** of each extraction tool **730** are aligned with an inserted into a hole **460** corresponding to a slot in which one of the chiclets is mounted. When the release pins **130** are inserted into the holes **460**, they press on the portion **132** of a latch **130** of the Chiclet, thereby releasing the latches **130** from the slots **440** in the module **400**. As the release pins **730** are pushed into the holes **460**, the body of each extraction tool moves closer to the chiclets and the plunger **740** of each extraction tool is pushed by the chiclet to the position shown in FIG. **8**A. Once the release pins are fully inserted into the holes **460** and the latches **130** of each of the chiclets has been released, the operator pushes the plungers **740** to push the chiclets **300** out of the module, as shown in FIG. **8**B. The extraction tool and the latches on the chiclet allow for re-programmability of an interface system. In other words, by removing, adding or changing chiclets in a module, an operator can reconfigure the input/output, I/O of the module.

An alternative embodiment of the present invention is shown in FIGS. **9**A-**9**L. In the alternative embodiment, a first chiclet has a twin beam separable structure. The twin beam design allows for a separable interface to a right angle termination insert, which offers a variety of terminations such as through hole straight mount, printed circuit board, PCB, through hole right angle PCB, compliant pin straight PCB, compliant pin right angle PCB and discrete wire termination configurations.

The twin-beam separable chiclet has a housing **100** identical to that shown and described in FIG. **1**. The termination subassembly, however, differs in that instead of the contacts being direct welded at their proximal end to wires, they extend to contact beams facing the opposite direction as shown in FIG. **9**A. Additionally, no potting material is injected into the housing **110**. In this manner, the first chiclet becomes a twin beam separable high speed data module contact set that can removably mate with a second chiclet, which, as shown in FIGS. **9**B-**9**C may be a right-angle high speed data contact set or chiclet **900**.

The right-angle chiclet **900** has a U-shaped housing **910** that is placed around molding **980** surrounding a plurality of contacts **972**, **972***a*, **974***a*, **974**, **976**, **976***a*, **978***a*, **978**. The molding **980** has openings **982** and **984**. The housing **910** has alignment posts **930** extending from one side and a hole **960** in that side through which potting material is injected. On the opposite side, U-shaped housing has a pair of holes or depressions **940** for receiving posts **930** of an adjacent right-angle chiclet if the chiclets are placed in a stacked configuration. The opposite side additionally has a hole **962** through which potting material may be injected.

The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible in light of the above teachings or may be acquired from practice of the invention. The embodiment was chosen and described in order to explain the principles of the invention and its practical application to enable one skilled in the art to utilize the invention in various embodiments as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents. The entirety of each of the aforementioned documents is incorporated by reference herein.

What is claimed is:

1. A high speed data contact set comprising:

an insert shroud comprising:

a hollow body having a top, a bottom, a front, a rear, and first side and a second side;

a plurality of protective arms extending from the front of said hollow body for protecting contact beams of a termination subassembly inserted into said insert shroud, each said protective arm having beveled edges at its distal end and an angled shoulder spaced from said distal end of said protective arm, said beveled edges providing a first stage of contact pre-alignment during engagement and said shoulder providing a second stage of contact pre-alignment during engagement; and

a latch on each of said first and second sides of said hollow body.

2. The high speed data contact set according to claim **1**, said insert shroud further comprising:

a plurality of raised bosses on said top of said hollow body for engaging with a plurality of hollows in an adjacent insert shroud.

3. The high speed data contact set according to claim **1**, said insert shroud further comprising:

a first keying member on said first side of said hollow body; and

a second keying member on said second side of said hollow body.

4. The high speed data contact set according to claim **1**, further comprising a termination subassembly in said insert shroud.

5. The high speed data contact set according to claim **4**, wherein said termination subassembly comprises:

a plurality of pairs of contact beams, the contact beams in each pair being of the same orientation and the pairs of contact beams having alternating orientations.

6. The high speed data contact set according to claim **1**, wherein said high speed data contact set is hermaphroditic.

7. The high speed data contact set according to claim **6**, wherein said termination subassembly has a welded wire termination.

8. The high speed data contact set according to claim **7**, further comprising potting material in said insert shroud with said termination subassembly.

9. The high speed data contact set according to claim **8**, wherein said potting material extends out of said shroud and surrounds a portion of a wire extending from said welded wire termination.

10. A high speed data contact set comprising:

an insert shroud comprising:

a hollow body having a top, a bottom, a front, a rear, and first side and a second side;

a plurality of raised bosses on said top of said hollow body for engaging with a plurality of hollows in an adjacent insert shroud;

an opening in said hollow body for inserting potting material into said hollow body; and

a latch on each of said first and second sides of said hollow body;

a termination subassembly in said insert shroud;

a plurality of wires connected to said termination assembly; and

potting material in said shroud and extending out of said shroud to surround connections between said plurality of wires and said termination subassembly.

11. The high speed data contact set according to claim **10**, said insert shroud further comprising:

a first keying member on said first side of said hollow body; and

a second keying member on said second side of said hollow body.

12. The high speed data contact set according to claim **10**, wherein said opening comprises a hole.

13. The high speed data contact set according to claim **10**, wherein said termination subassembly comprises:

a plurality of pairs of contact beams, the contact beams in each pair being of the same orientation and the pairs of contact beams having alternating orientations.

14. The high speed data contact set according to claim **10**, wherein said high speed data contact set is hermaphroditic.

15. A high speed data contact set comprising:

a housing comprising:

a hollow body having a top, a bottom, a front, a rear, and first side and a second side;

a plurality of raised bosses on said top of said hollow body for engaging with a plurality of hollows in an adjacent housing;

a latch on each of said first and second sides of said hollow body;

a termination subassembly in said hollow body, said termination subassembly comprising:

a plurality of pairs of contact beams, the contact beams in each pair being of the same orientation and the pairs of contact beams having alternating orientations.

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